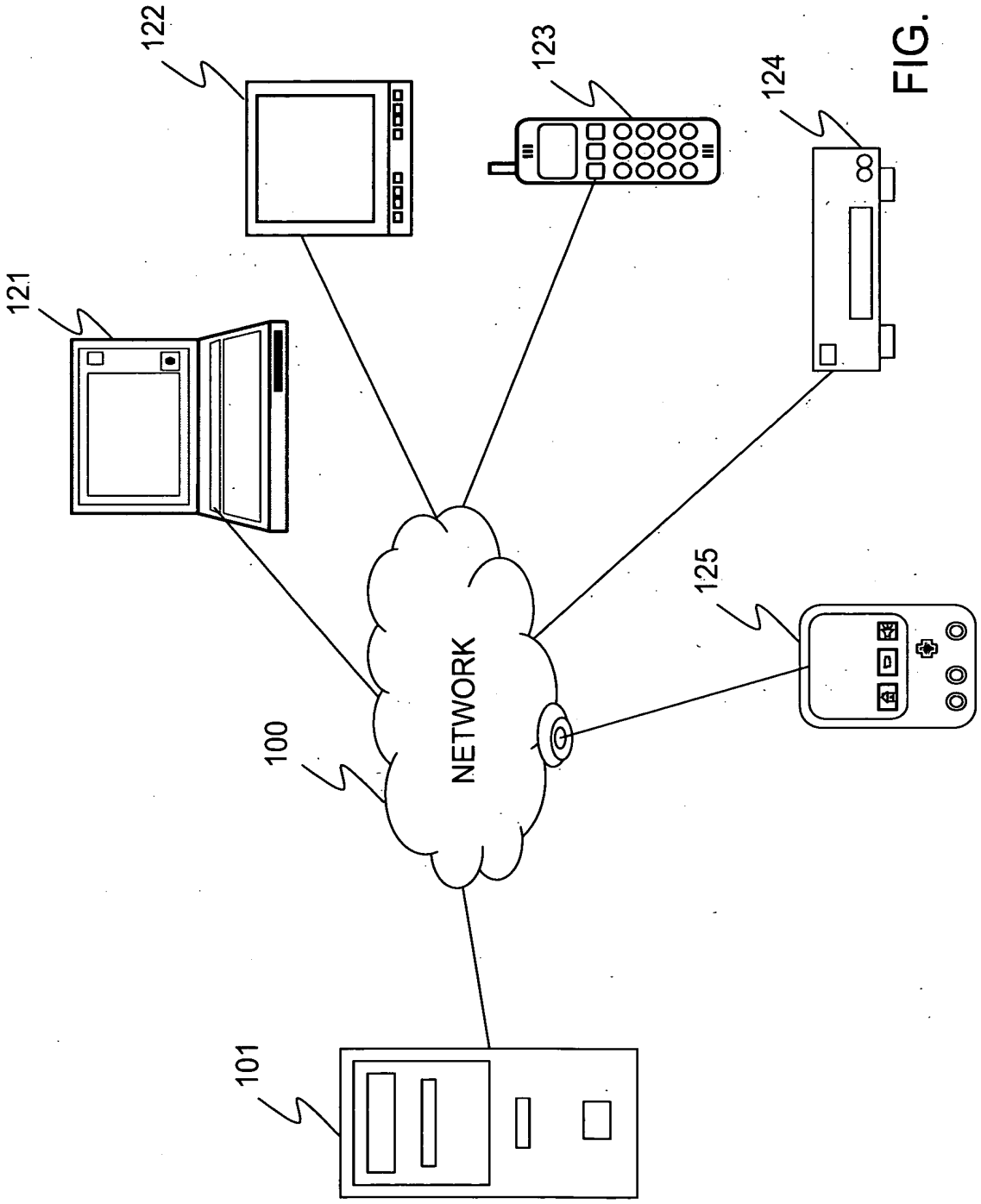


FIG. 1

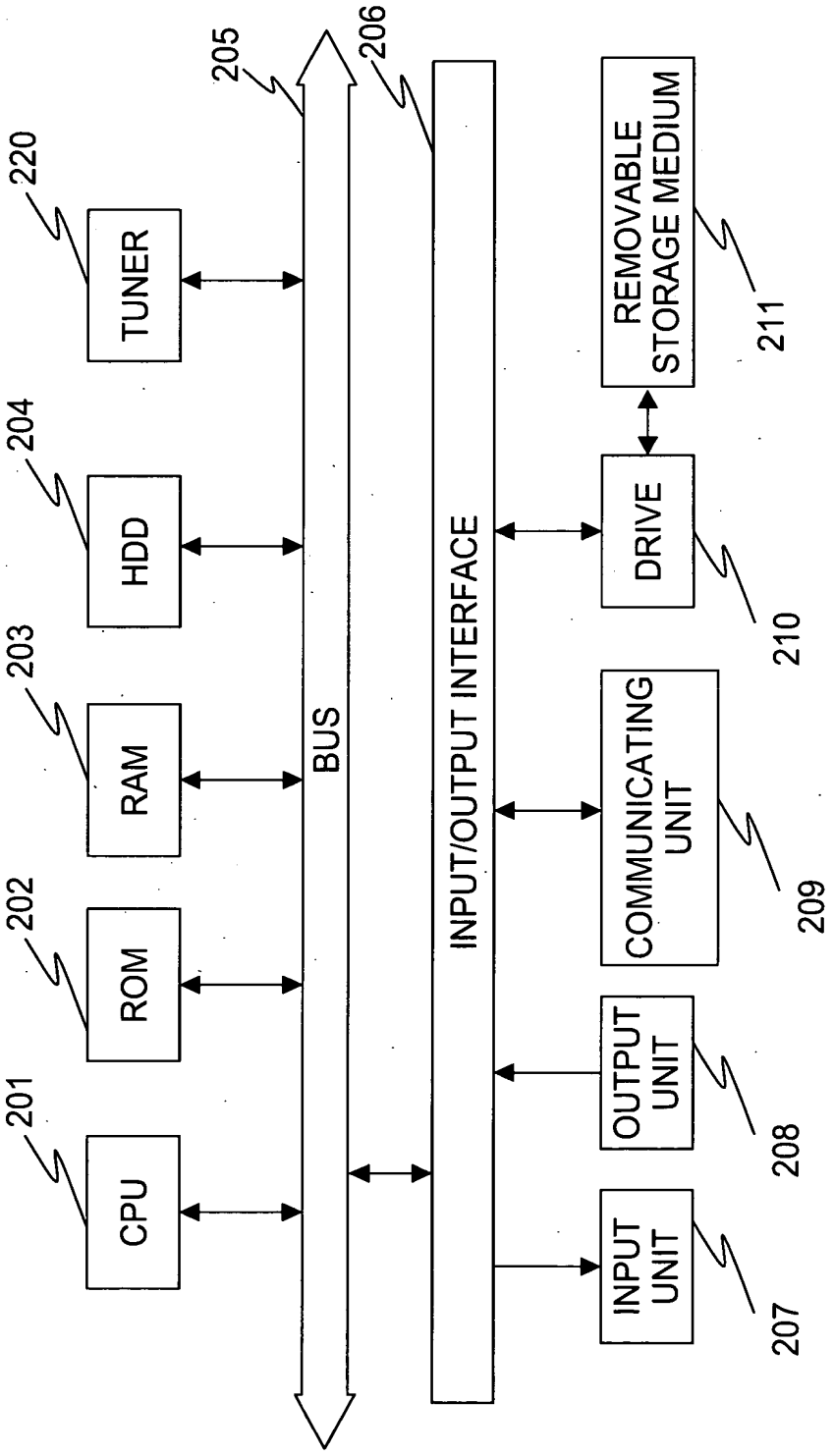

CPU
201
ROM
202
RAM
203
HDD
204
TUNER
220
205
BUS
206
INPUT/OUTPUT INTERFACE
INPUT UNIT
207
OUTPUT UNIT
208
COMMUNICATING UNIT
209
DRIVE
210
REMOVABLE STORAGE MEDIUM
211

FIG. 2

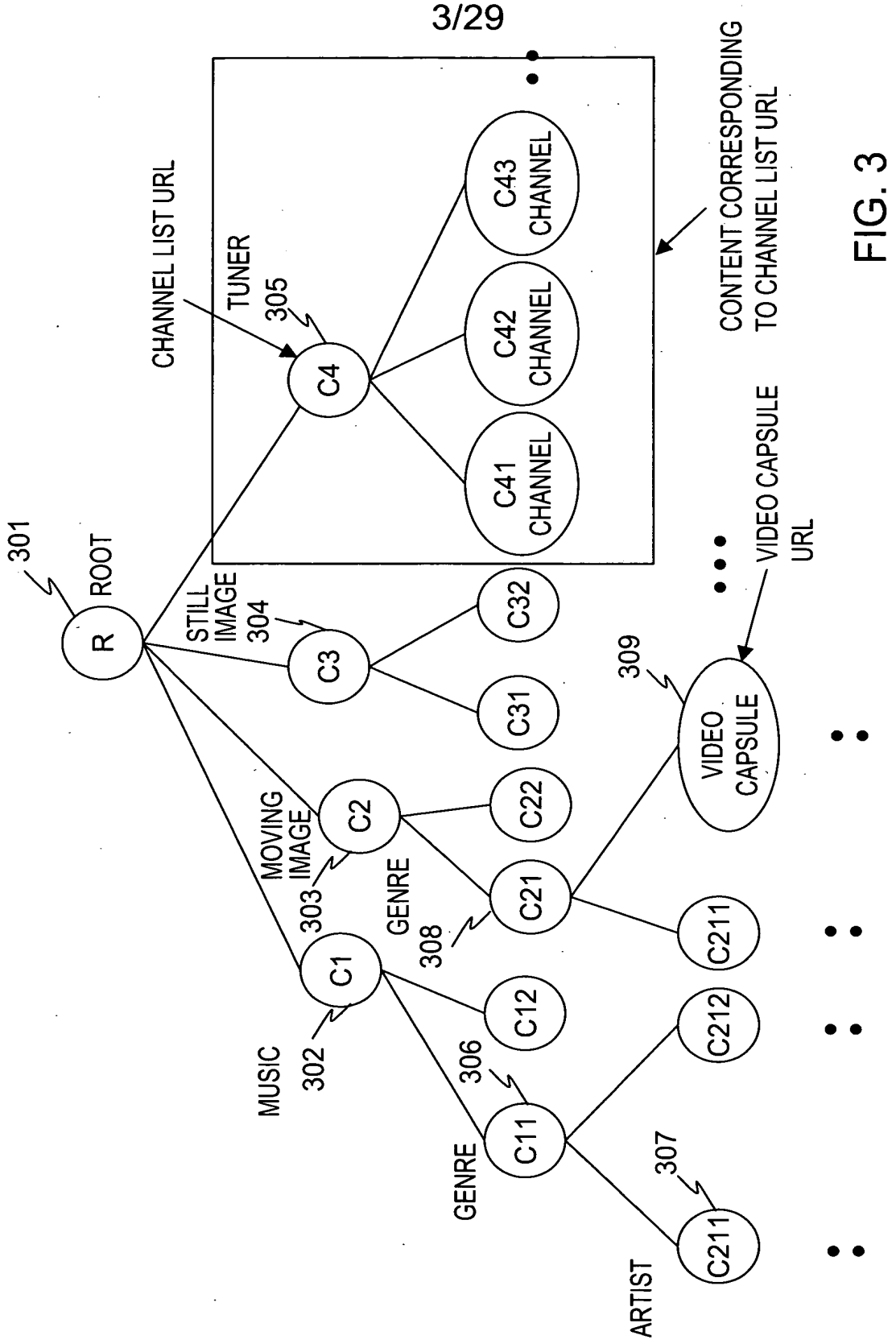

301
ROOT
R
CHANNEL LIST URL
TUNER
305
C4
C43 CHANNEL
C42 CHANNEL
C41 CHANNEL
CONTENT CORRESPONDING TO CHANNEL LIST URL
STILL IMAGE
304
C3
C32
C31
VIDEO CAPSULE URL
309
VIDEO CAPSULE
MOVING IMAGE
303
C2
C22
C21
C211
GENRE
308
MUSIC
302
C1
C12
C11
C212
306
GENRE
307
C211
ARTIST

FIG. 3

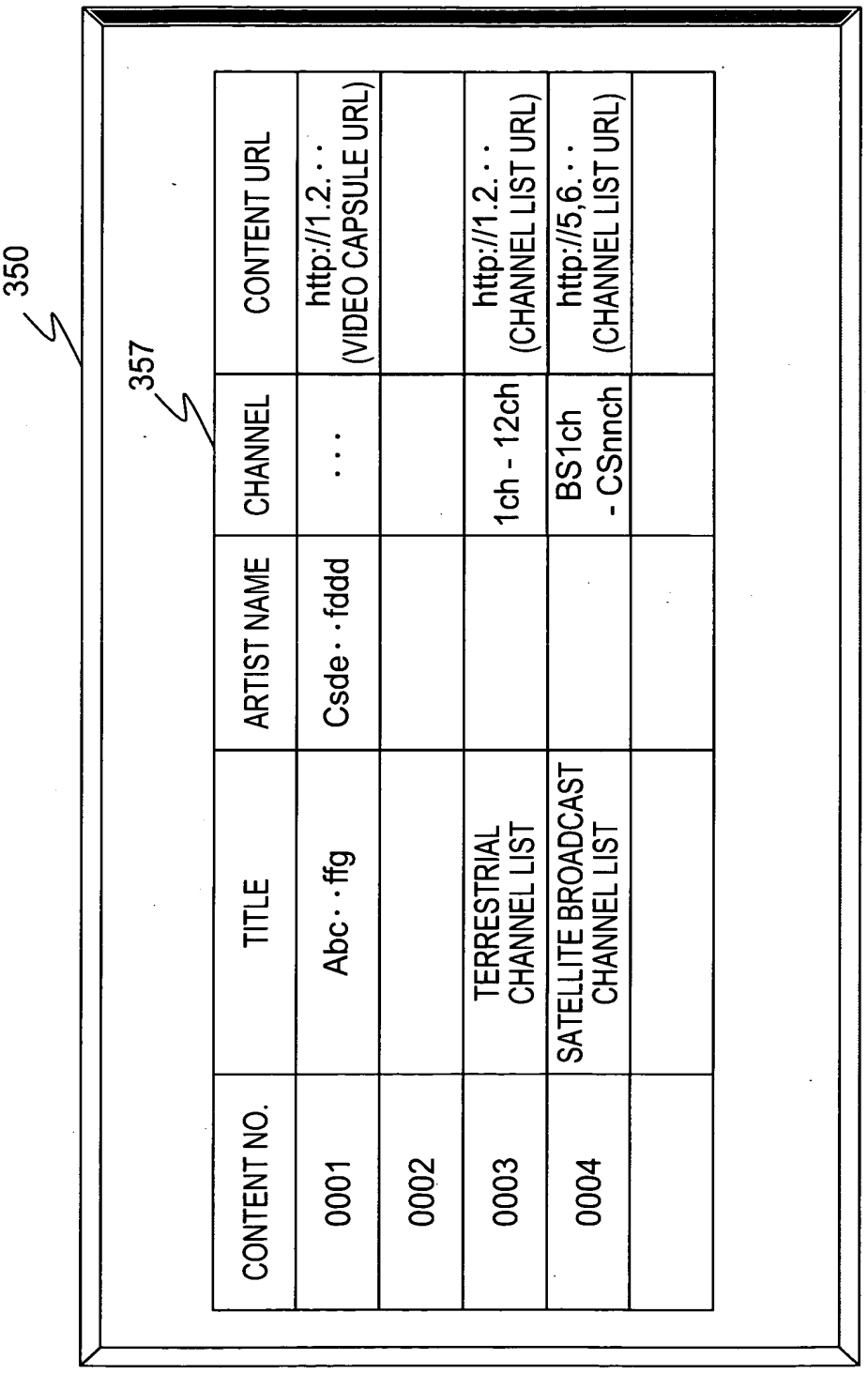
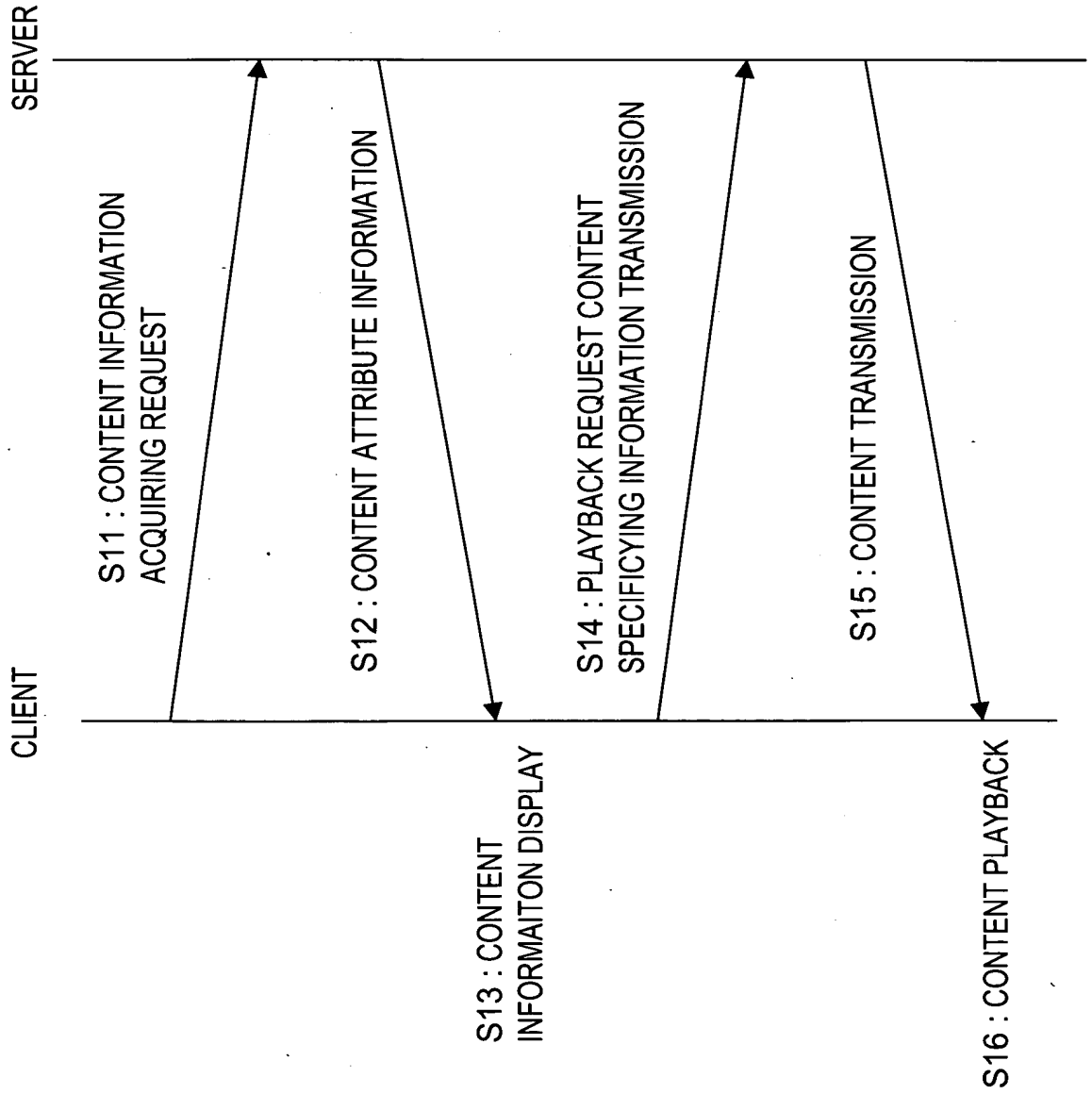

350
357
CONTENT NO.
TITLE
ARTIST NAME
CHANNEL
CONTENT URL
0001
Abc · · ffg
Csde · · fddd
· · ·
http://1.2. · ·
(VIDEO CAPSULE URL)
0002
0003
TERRESTRIAL
CHANNEL LIST
1ch - 12ch
http://1.2. · ·
(CHANNEL LIST URL)
0004
SATELLITE BROADCAST
CHANNEL LIST
BS1ch
- CSnnch
http://5,6. · ·
(CHANNEL LIST URL)

FIG. 4

FIG. 5


SERVER
CLIENT
S11 : CONTENT INFORMATION ACQUIRING REQUEST
S12 : CONTENT ATTRIBUTE INFORMATION
S13 : CONTENT INFORMAITON DISPLAY
S14 : PLAYBACK REQUEST CONTENT SPECIFICYING INFORMATION TRANSMISSION
S15 : CONTENT TRANSMISSION
S16 : CONTENT PLAYBACK

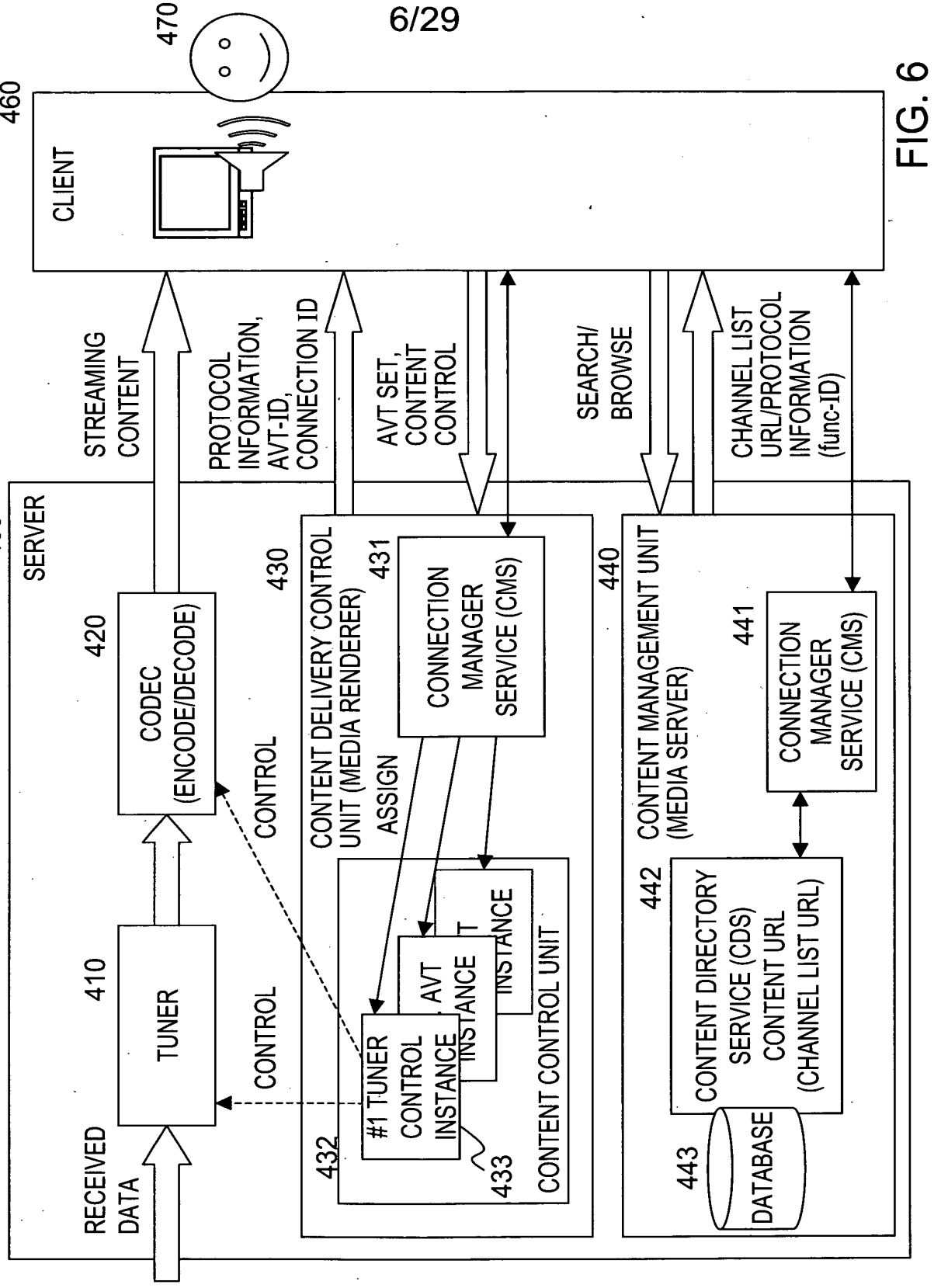

470
460
CLIENT
STREAMING CONTENT
PROTOCOL INFORMATION, AVT-ID, CONNECTION ID
AVT SET, CONTENT CONTROL
SEARCH/ BROWSE
CHANNEL LIST URL/PROTOCOL INFORMATION (func-ID)
400
SERVER
420
CODEC (ENCODE/DECODE)
410
TUNER
RECEIVED DATA
CONTROL
CONTROL
430
CONTENT DELIVERY CONTROL UNIT (MEDIA RENDERER)
431
CONNECTION MANAGER SERVICE (CMS)
ASSIGN
#1 TUNER CONTROL INSTANCE
AVT INSTANCE
T INSTANCE
432
433
CONTENT CONTROL UNIT
440
CONTENT MANAGEMENT UNIT (MEDIA SERVER)
441
CONNECTION MANAGER SERVICE (CMS)
442
CONTENT DIRECTORY SERVICE (CDS) CONTENT URL (CHANNEL LIST URL)
443
DATABASE

FIG. 6

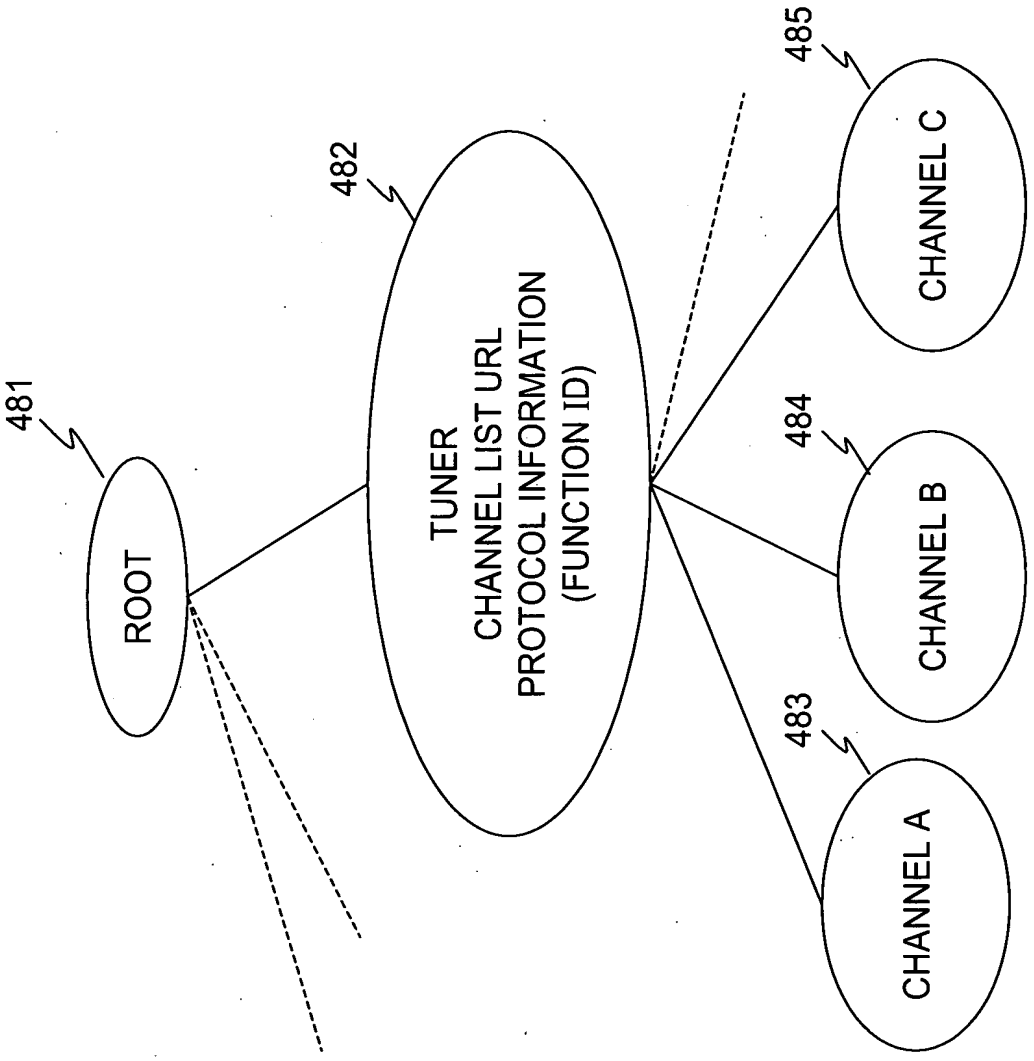

481
ROOT
482
TUNER
CHANNEL LIST URL
PROTOCOL INFORMATION
(FUNCTION ID)
483
CHANNEL A
484
CHANNEL B
485
CHANNEL C
• • •

FIG. 7

(a)

```
<container id="ch-list" parentID="-1" restricted="1" ...>
<dc:title> TERRESTRIAL CHANNEL LIST </dc:title>
<upnp:class>object.container.function.avVideoTuner</upnp:class>
...
<av:allowedOperation>Play</av:allowedOperation>
<av:eventingURI>http://1.2.3.4:56000/SENA?id=live</av:eventingURI>
<res protocolInfo="http-get:*:video/mpeg:func-id=t01" av:codec="MPEG1V" ...>
http://1.2.3.4:56000/liveoutUrl
</res>
</container>
```

492

491

(b)

```
<item id="ch8" parentID="dev0" restricted="1">
<dc:title>TOKYO TELEVISION </dc:title>
<upnp:class>object.item.videoItem.videoBroadcast.avChannel
</upnp:class>
<upnp:channelName>TOKYO TELEVISION </upnp:channelName>
<upnp:channelNr>8</upnp:channelNr>
...
</item>
```

FIG. 8

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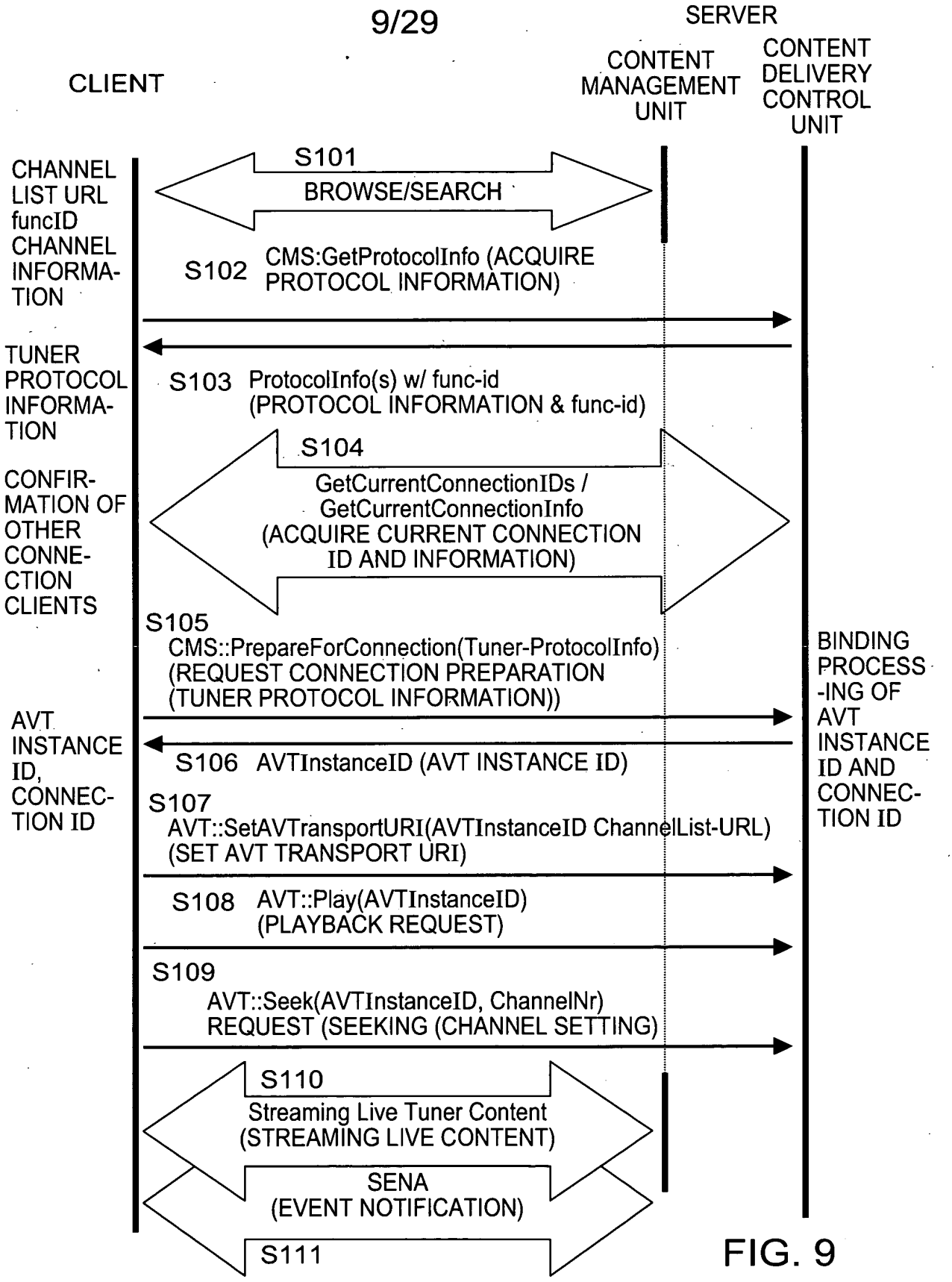
CLIENT
SERVER
CONTENT MANAGEMENT UNIT
CONTENT DELIVERY CONTROL UNIT
CHANNEL LIST URL funcID CHANNEL INFORMA-TION
S101
BROWSE/SEARCH
S102
CMS:GetProtocolInfo (ACQUIRE PROTOCOL INFORMATION)
TUNER PROTOCOL INFORMA-TION
S103
ProtocolInfo(s) w/ func-id
(PROTOCOL INFORMATION & func-id)
CONFIR-MATION OF OTHER CONNE-CTION CLIENTS
S104
GetCurrentConnectionIDs / GetCurrentConnectionInfo
(ACQUIRE CURRENT CONNECTION ID AND INFORMATION)
S105
CMS::PrepareForConnection(Tuner-ProtocolInfo)
(REQUEST CONNECTION PREPARATION (TUNER PROTOCOL INFORMATION))
BINDING PROCESS-ING OF AVT INSTANCE ID AND CONNEC-TION ID
AVT INSTANCE ID, CONNEC-TION ID
S106
AVTInstanceID (AVT INSTANCE ID)
S107
AVT::SetAVTransportURI(AVTInstanceID ChannelList-URL)
(SET AVT TRANSPORT URI)
S108
AVT::Play(AVTInstanceID)
(PLAYBACK REQUEST)
S109
AVT::Seek(AVTInstanceID, ChannelNr)
REQUEST (SEEKING (CHANNEL SETTING)
S110
Streaming Live Tuner Content
(STREAMING LIVE CONTENT)
SENA
(EVENT NOTIFICATION)
S111

FIG. 9

CLIENT	CONNECTION ID	AVT INSTANCE ID	PROTOCOL INFORMATION
CLIENT A	123aac33	AB66ac33	MPEG
CLIENT B	253bed31	CD54ed22	internal:1.2.3.4:application /x-av-tuner-content:func-id=t01
:	:	:	:
CLIENT N	753bab55	ED78ab21	ATRAC

FIG. 10

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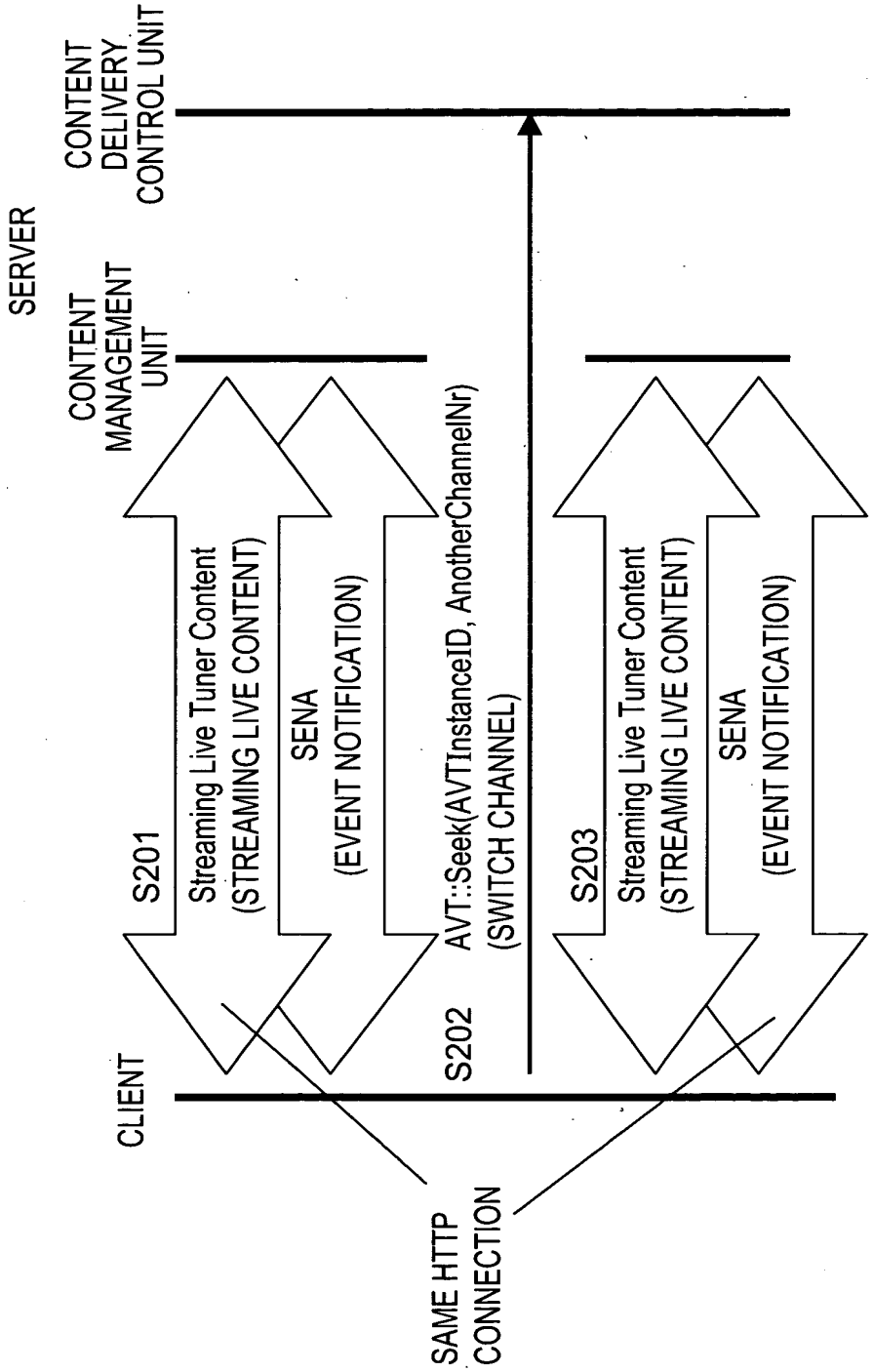

SERVER
CONTENT DELIVERY CONTROL UNIT
CONTENT MANAGEMENT UNIT
CLIENT
S201
Streaming Live Tuner Content (STREAMING LIVE CONTENT)
SENA (EVENT NOTIFICATION)
AVT::Seek(AVTInstanceID, AnotherChannelNr) (SWITCH CHANNEL)
S202
S203
Streaming Live Tuner Content (STREAMING LIVE CONTENT)
SENA (EVENT NOTIFICATION)
SAME HTTP CONNECTION

FIG. 11

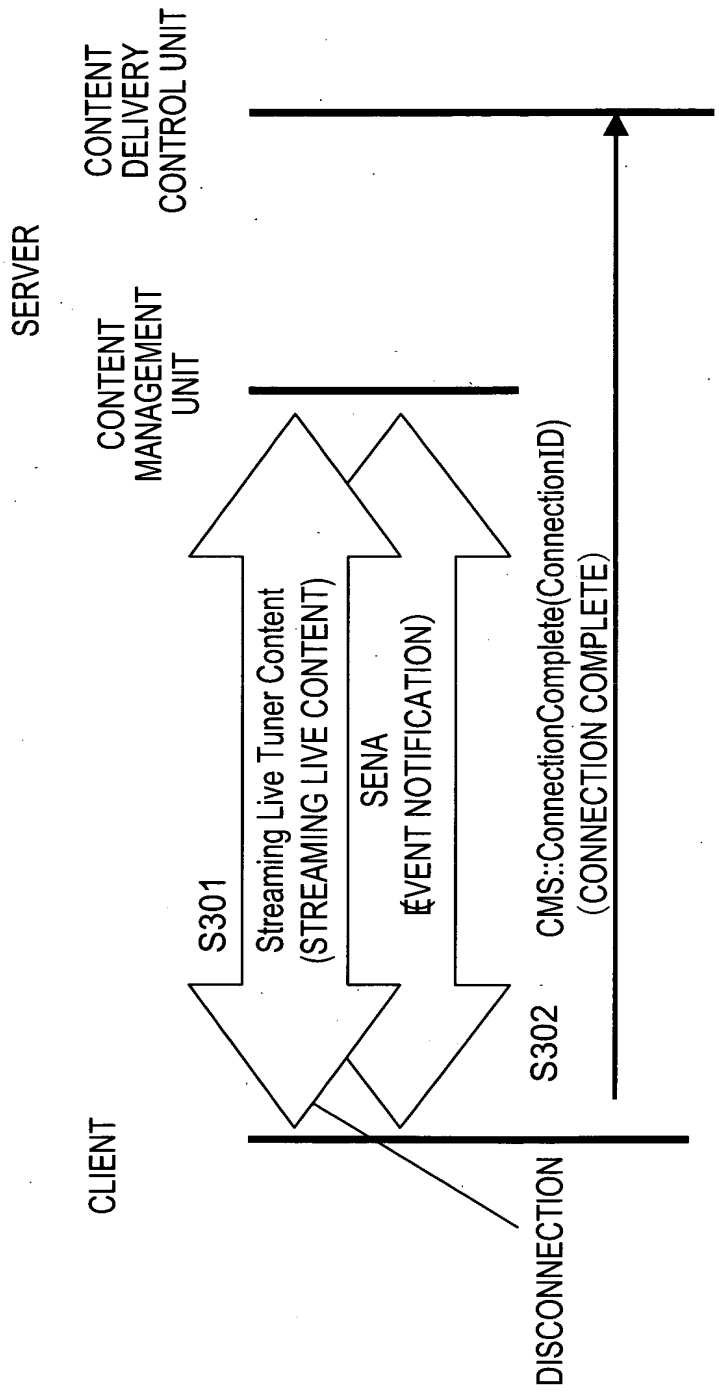

SERVER
CONTENT DELIVERY CONTROL UNIT
CONTENT MANAGEMENT UNIT
CLIENT
S301
Streaming Live Tuner Content (STREAMING LIVE CONTENT)
SENA
EVENT NOTIFICATION)
S302
CMS::ConnectionComplete(ConnectionID) (CONNECTION COMPLETE)
DISCONNECTION

FIG. 12

FIG. 13

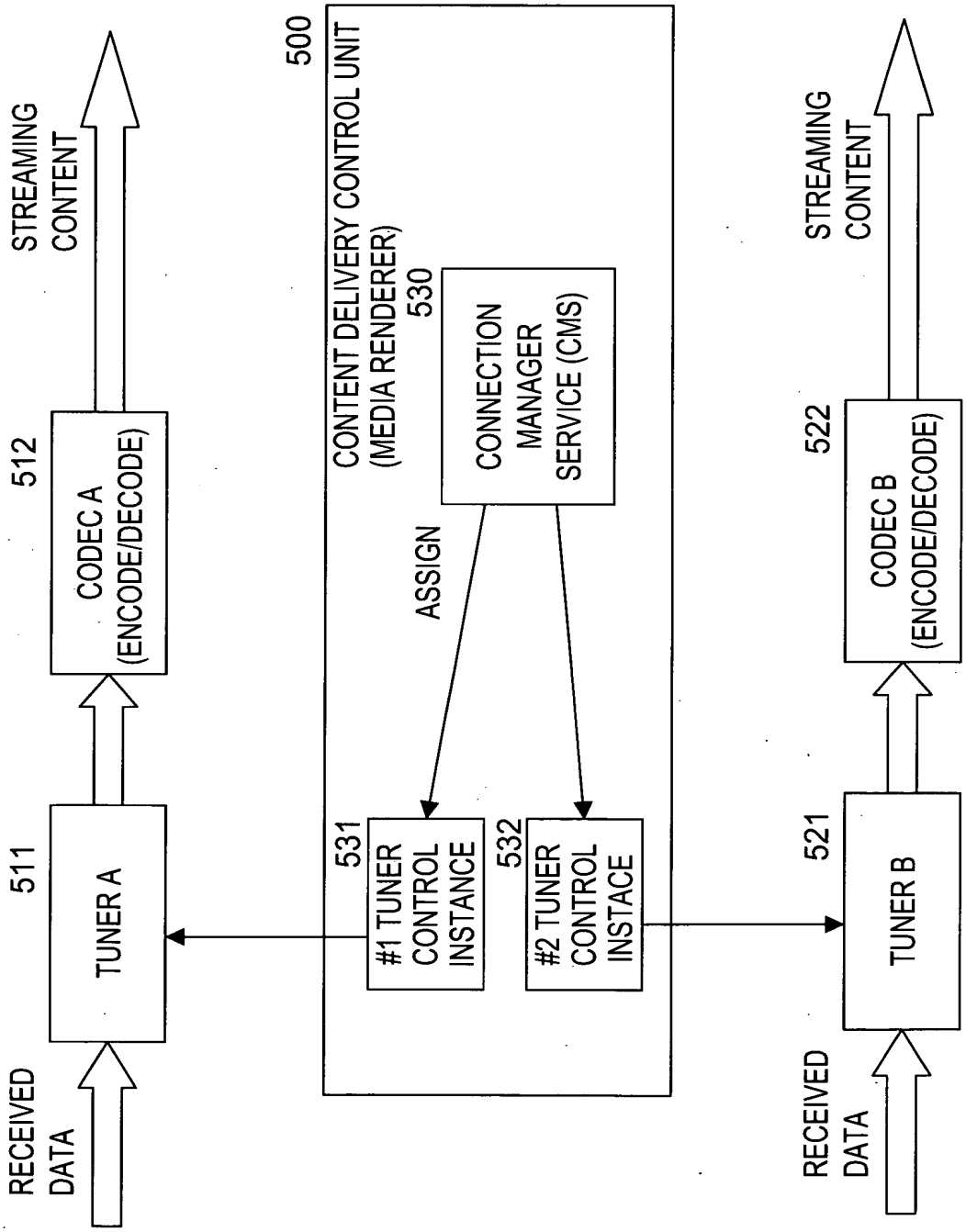
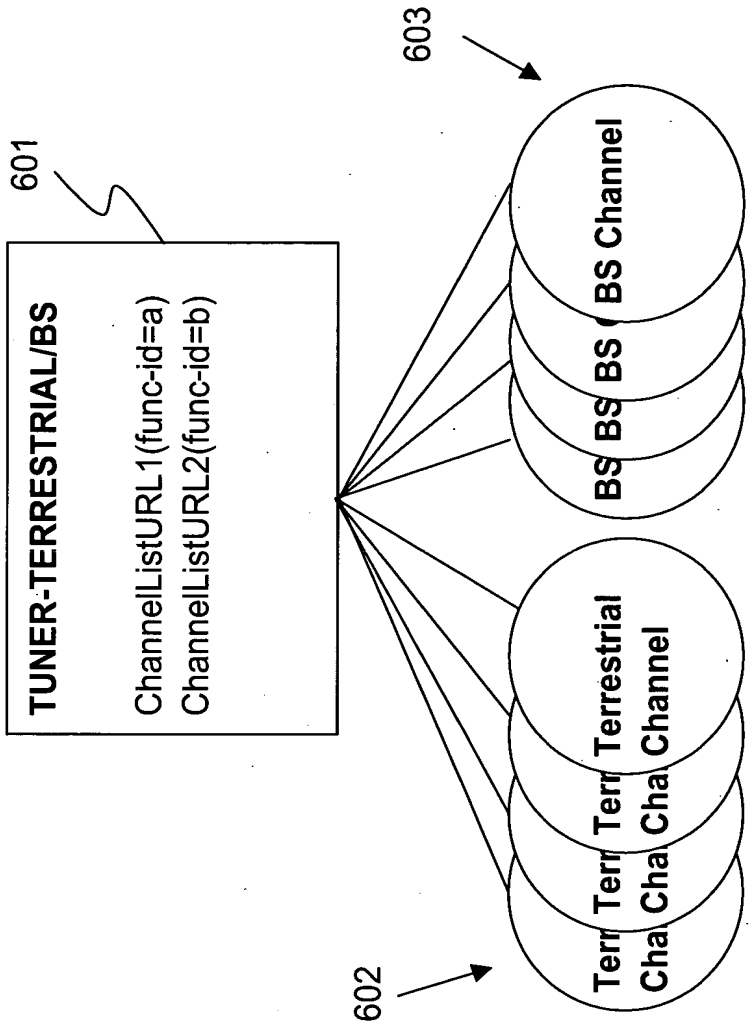

500
CONTENT DELIVERY CONTROL UNIT
(MEDIA RENDERER)
530
CONNECTION MANAGER SERVICE (CMS)
ASSIGN
531
#1 TUNER CONTROL INSTANCE
532
#2 TUNER CONTROL INSTACE
511
TUNER A
521
TUNER B
512
CODEC A (ENCODE/DECODE)
522
CODEC B (ENCODE/DECODE)
STREAMING CONTENT
STREAMING CONTENT
RECEIVED DATA
RECEIVED DATA

FIG. 14


601
TUNER-TERRESTRIAL/BS
ChannelListURL1(func-id=a)
ChannelListURL2(func-id=b)
603
602
BS Channel
Terrestrial Channel

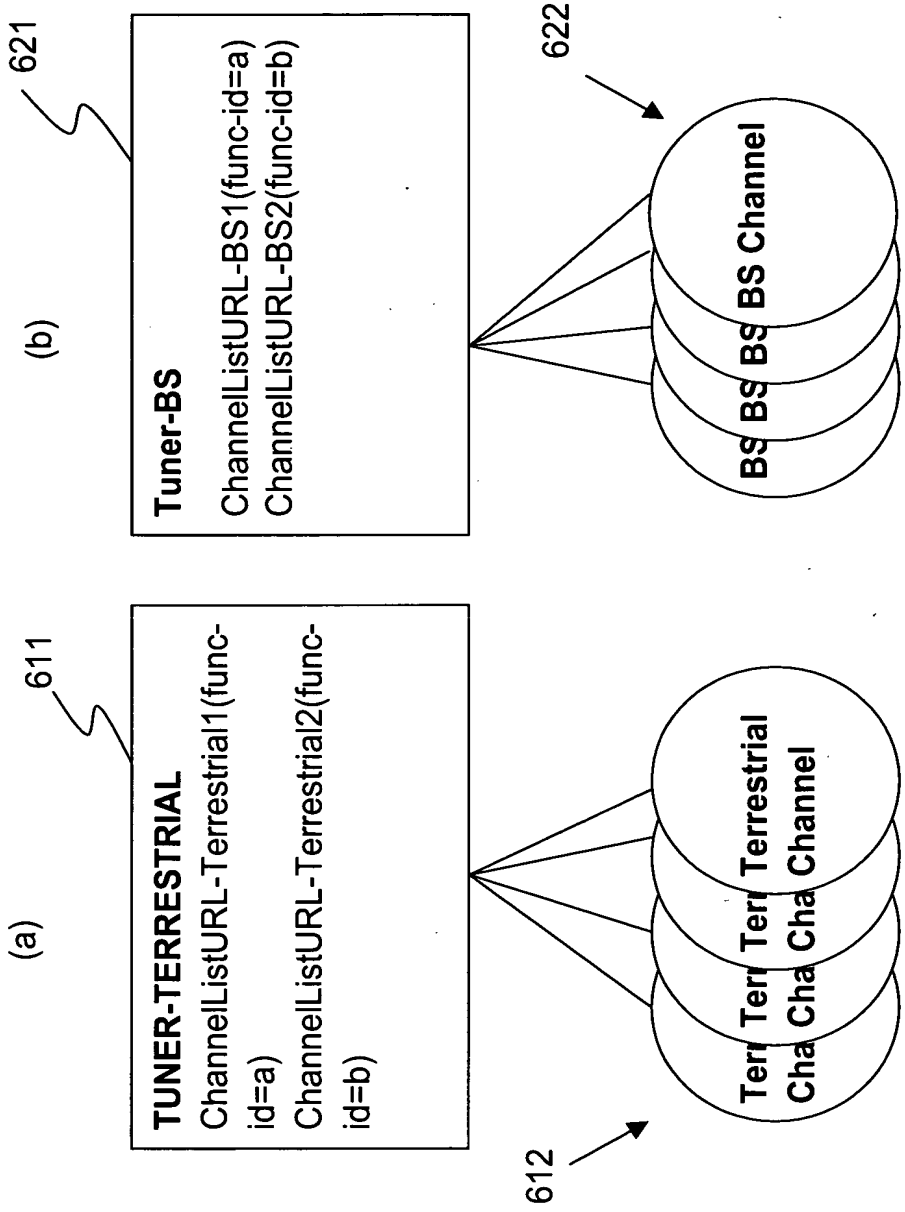

(a)
611
TUNER-TERRESTRIAL
ChannelListURL-Terrestrial1(func-id=a)
ChannelListURL-Terrestrial2(func-id=b)
612
Terr Terr Terrestrial
Cha Cha Cha Channel
(b)
621
Tuner-BS
ChannelListURL-BS1(func-id=a)
ChannelListURL-BS2(func-id=b)
622
BS BS BS BS Channel

FIG. 15

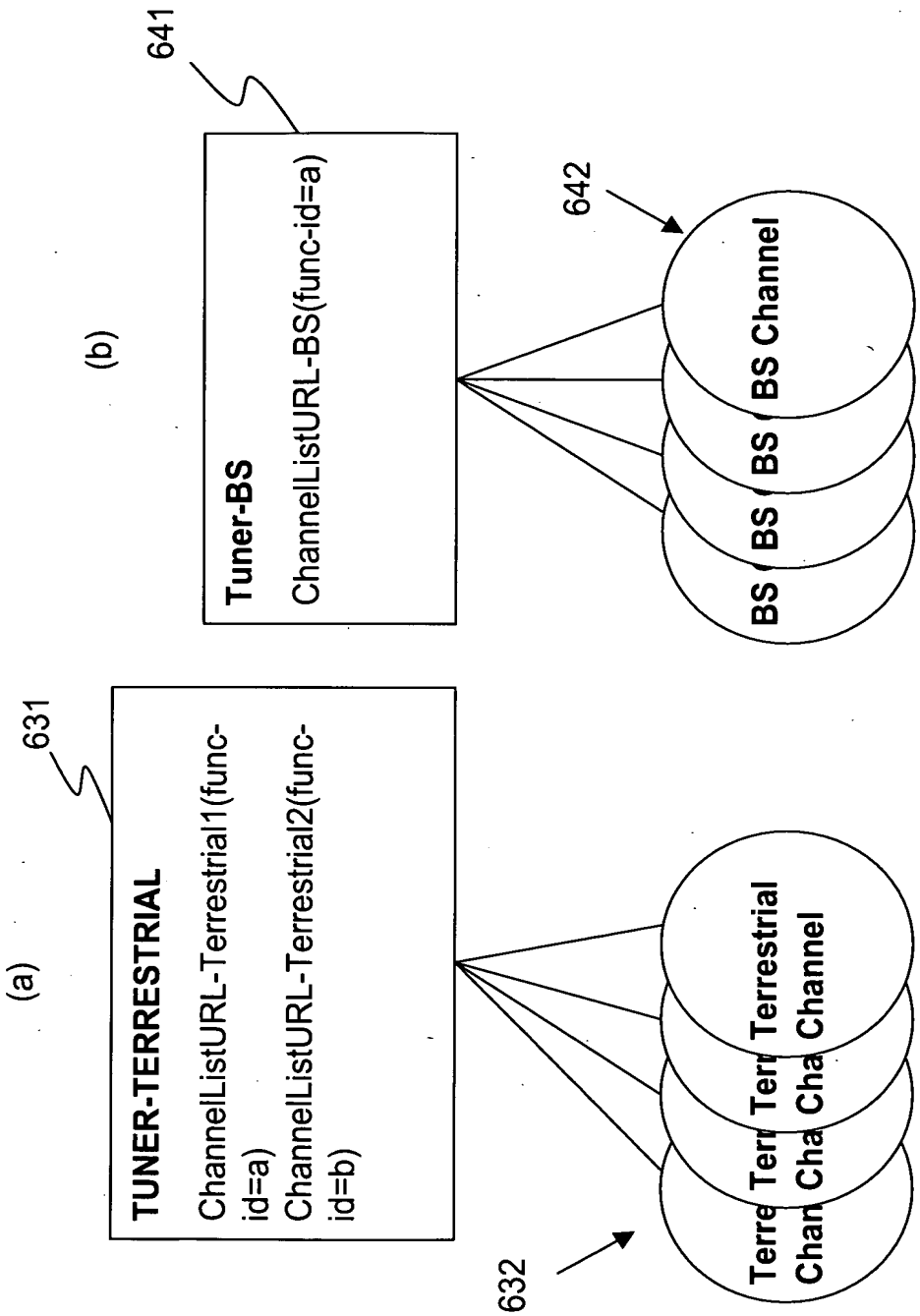

(a)
631
TUNER-TERRESTRIAL
ChannelListURL-Terrestrial1(func-id=a)
ChannelListURL-Terrestrial2(func-id=b)
632
Terrestrial Channel
(b)
641
Tuner-BS
ChannelListURL-BS(func-id=a)
642
BS Channel

FIG. 16

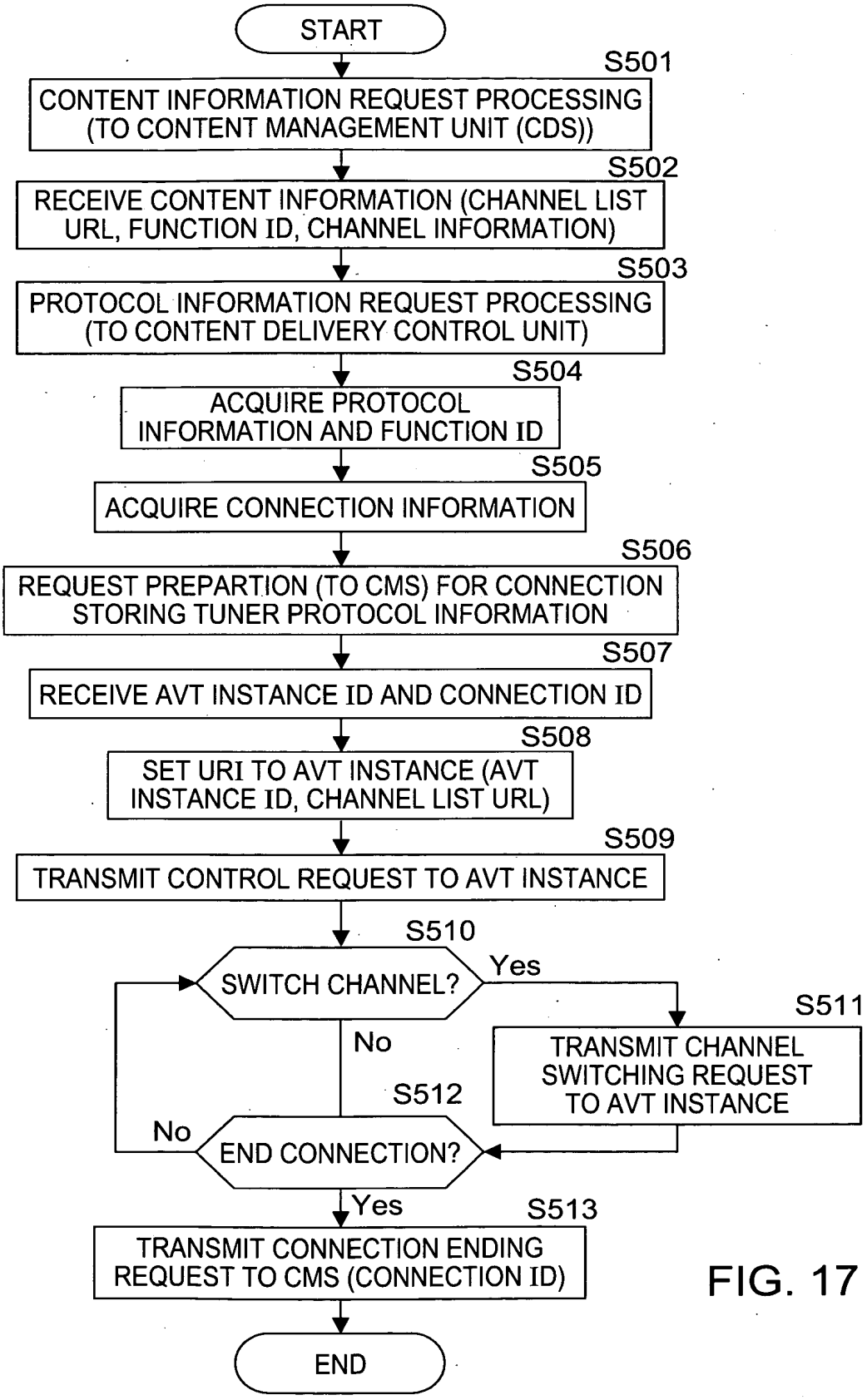

START
S501
CONTENT INFORMATION REQUEST PROCESSING (TO CONTENT MANAGEMENT UNIT (CDS))
S502
RECEIVE CONTENT INFORMATION (CHANNEL LIST URL, FUNCTION ID, CHANNEL INFORMATION)
S503
PROTOCOL INFORMATION REQUEST PROCESSING (TO CONTENT DELIVERY CONTROL UNIT)
S504
ACQUIRE PROTOCOL INFORMATION AND FUNCTION ID
S505
ACQUIRE CONNECTION INFORMATION
S506
REQUEST PREPARTION (TO CMS) FOR CONNECTION STORING TUNER PROTOCOL INFORMATION
S507
RECEIVE AVT INSTANCE ID AND CONNECTION ID
S508
SET URI TO AVT INSTANCE (AVT INSTANCE ID, CHANNEL LIST URL)
S509
TRANSMIT CONTROL REQUEST TO AVT INSTANCE
S510
SWITCH CHANNEL?
Yes
S511
TRANSMIT CHANNEL SWITCHING REQUEST TO AVT INSTANCE
No
S512
END CONNECTION?
No
Yes
S513
TRANSMIT CONNECTION ENDING REQUEST TO CMS (CONNECTION ID)
END

FIG. 17

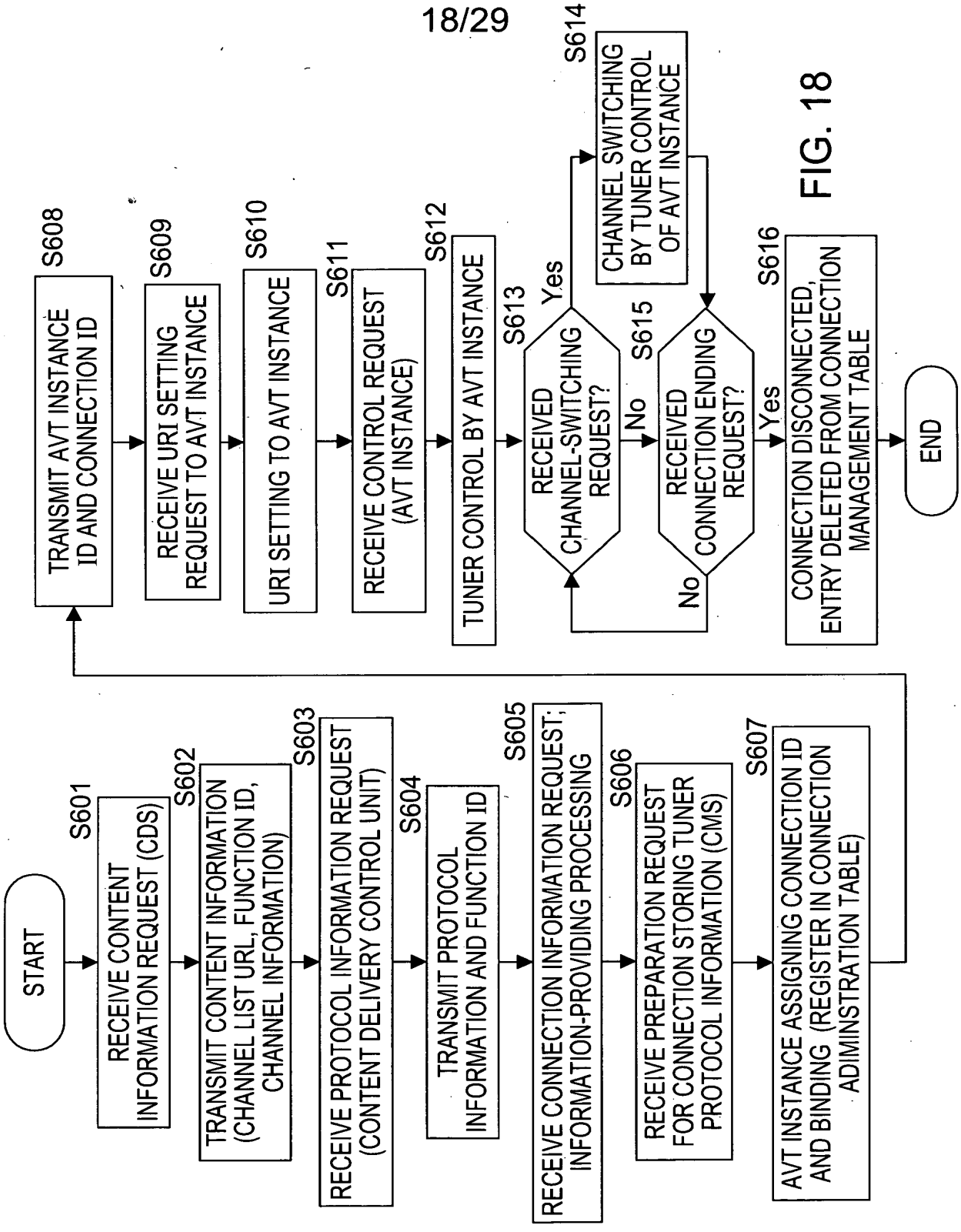

START
S601
RECEIVE CONTENT INFORMATION REQUEST (CDS)
S602
TRANSMIT CONTENT INFORMATION (CHANNEL LIST URL, FUNCTION ID, CHANNEL INFORMATION)
S603
RECEIVE PROTOCOL INFORMATION REQUEST (CONTENT DELIVERY CONTROL UNIT)
S604
TRANSMIT PROTOCOL INFORMATION AND FUNCTION ID
S605
RECEIVE CONNECTION INFORMATION REQUEST; INFORMATION-PROVIDING PROCESSING
S606
RECEIVE PREPARATION REQUEST FOR CONNECTION STORING TUNER PROTOCOL INFORMATION (CMS)
S607
AVT INSTANCE ASSIGNING CONNECTION ID AND BINDING (REGISTER IN CONNECTION ADIMINSTRATION TABLE)
S608
TRANSMIT AVT INSTANCE ID AND CONNECTION ID
S609
RECEIVE URI SETTING REQUEST TO AVT INSTANCE
S610
URI SETTING TO AVT INSTANCE
S611
RECEIVE CONTROL REQUEST (AVT INSTANCE)
S612
TUNER CONTROL BY AVT INSTANCE
S613
RECEIVED CHANNEL-SWITCHING REQUEST?
Yes
S614
CHANNEL SWITCHING BY TUNER CONTROL OF AVT INSTANCE
No
S615
RECEIVED CONNECTION ENDING REQUEST?
No
Yes
S616
CONNECTION DISCONNECTED, ENTRY DELETED FROM CONNECTION MANAGEMENT TABLE
END

FIG. 18

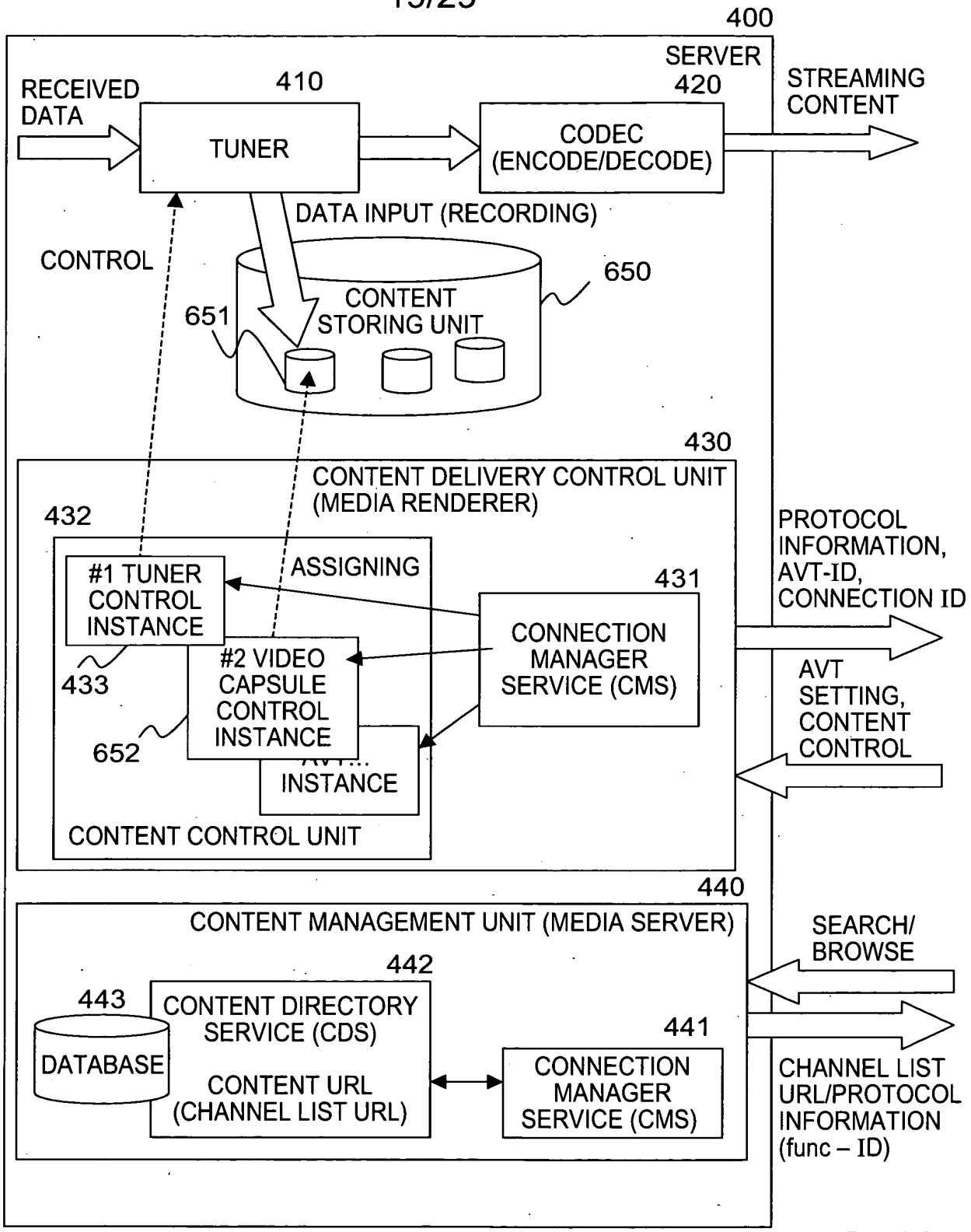

400
SERVER
RECEIVED DATA
410
TUNER
420
CODEC (ENCODE/DECODE)
STREAMING CONTENT
DATA INPUT (RECORDING)
CONTROL
650
651
CONTENT STORING UNIT
430
CONTENT DELIVERY CONTROL UNIT (MEDIA RENDERER)
432
#1 TUNER CONTROL INSTANCE
ASSIGNING
431
CONNECTION MANAGER SERVICE (CMS)
PROTOCOL INFORMATION, AVT-ID, CONNECTION ID
433
#2 VIDEO CAPSULE CONTROL INSTANCE
AVT SETTING, CONTENT CONTROL
652
INSTANCE
CONTENT CONTROL UNIT
440
CONTENT MANAGEMENT UNIT (MEDIA SERVER)
SEARCH/ BROWSE
442
443
CONTENT DIRECTORY SERVICE (CDS)
441
DATABASE
CONTENT URL (CHANNEL LIST URL)
CONNECTION MANAGER SERVICE (CMS)
CHANNEL LIST URL/PROTOCOL INFORMATION (func – ID)

FIG. 19

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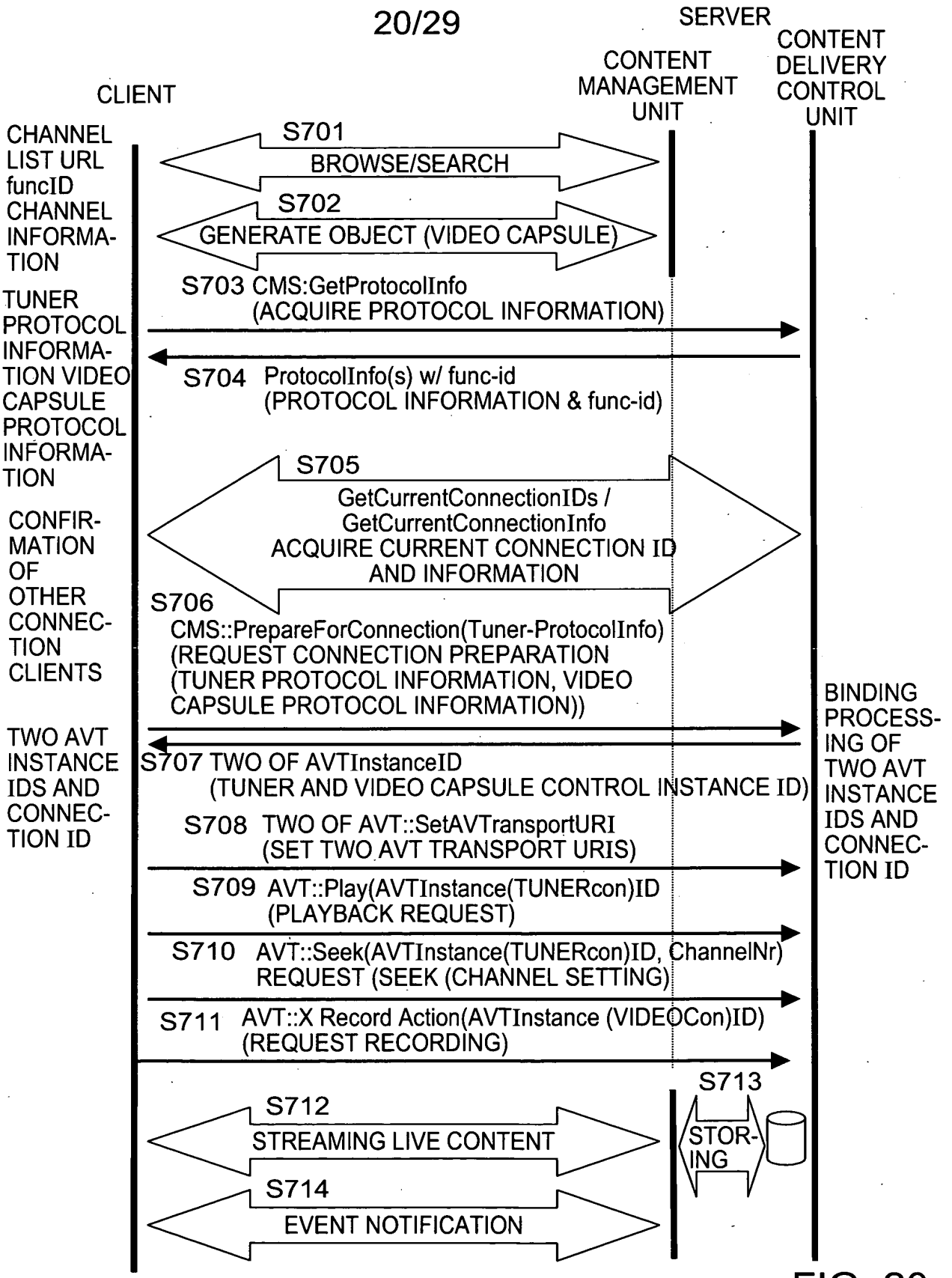

FIG .20

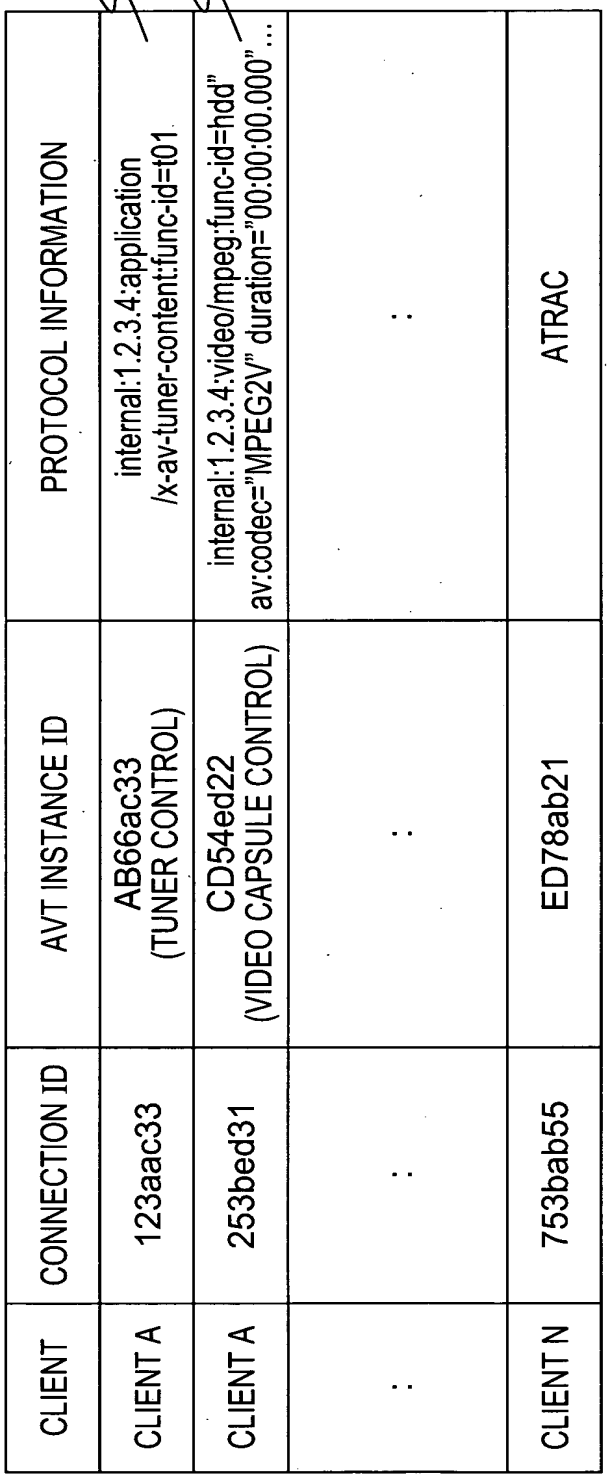
681
682
CLIENT
CONNECTION ID
AVT INSTANCE ID
PROTOCOL INFORMATION
CLIENT A
123aac33
AB66ac33
(TUNER CONTROL)
internal:1.2.3.4:application
/x-av-tuner-content:func-id=t01
CLIENT A
253bed31
CD54ed22
(VIDEO CAPSULE CONTROL)
internal:1.2.3.4:video/mpeg:func-id=hdd"
av:codec="MPEG2V" duration="00:00:00.000"...
CLIENT N
753bab55
ED78ab21
ATRAC

FIG. 21

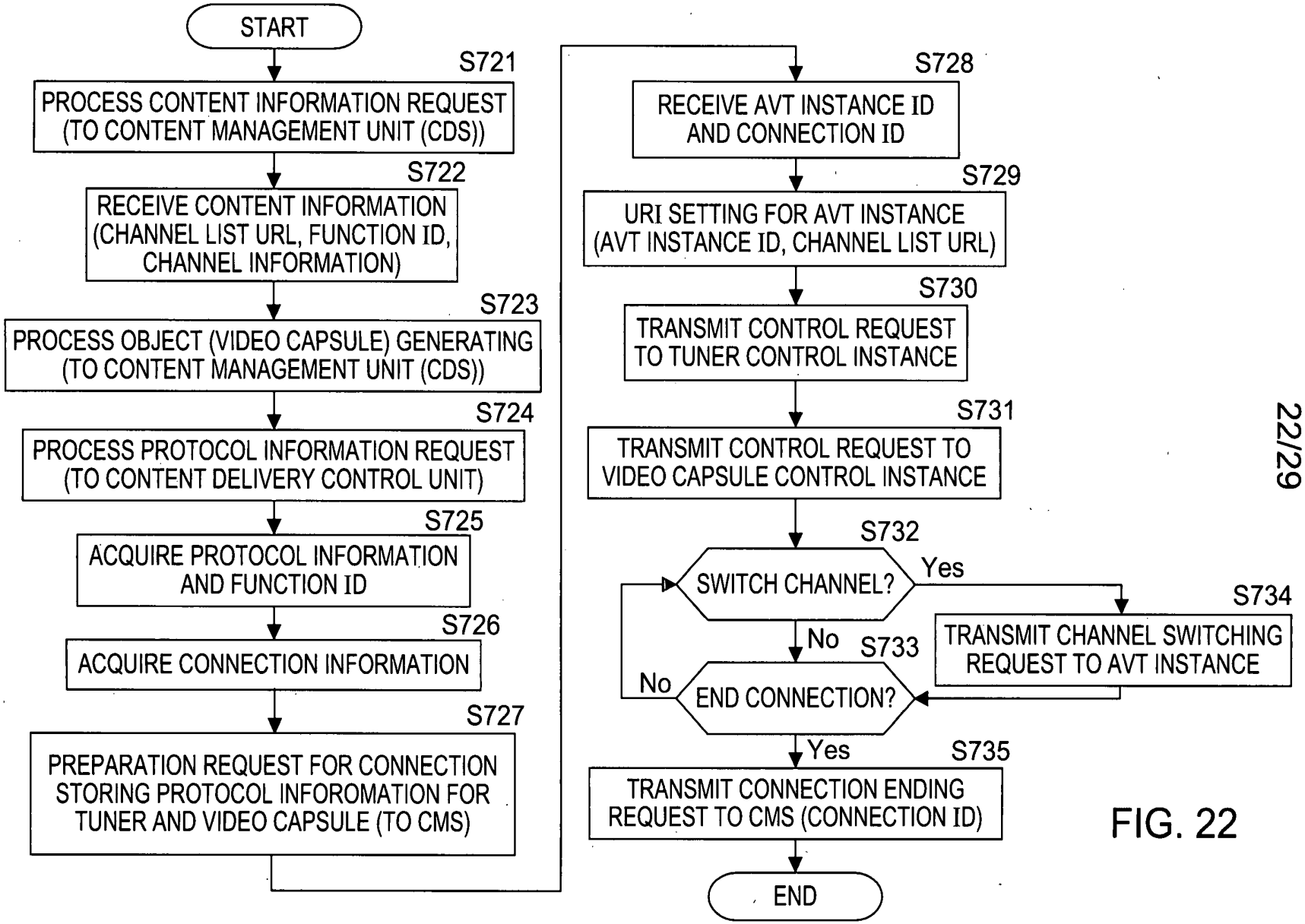

FIG. 22

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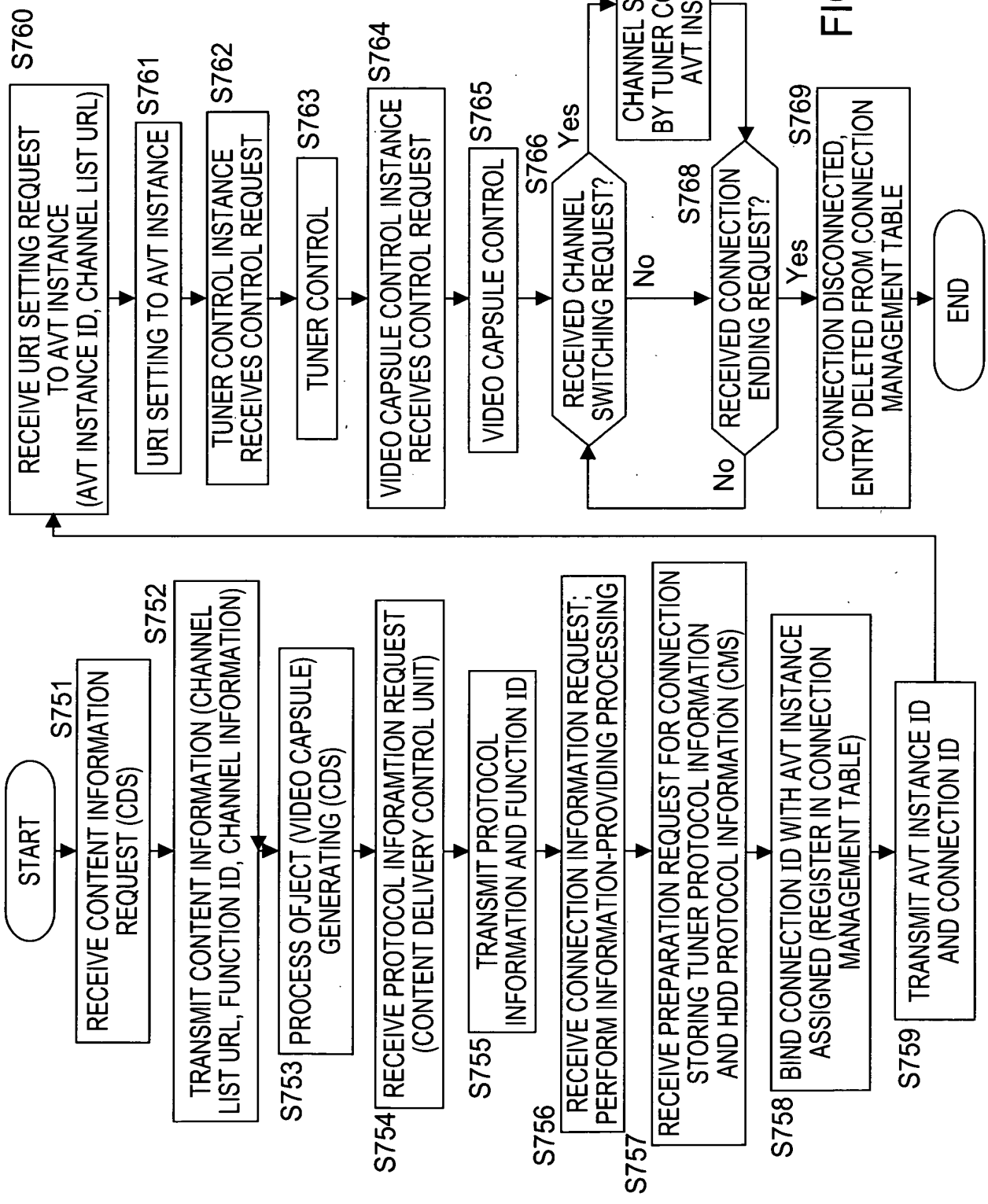
START
S751
RECEIVE CONTENT INFORMATION REQUEST (CDS)
S752
TRANSMIT CONTENT INFORMATION (CHANNEL LIST URL, FUNCTION ID, CHANNEL INFORMATION)
S753
PROCESS OFJECT (VIDEO CAPSULE) GENERATING (CDS)
S754
RECEIVE PROTOCOL INFORAMTION REQUEST (CONTENT DELIVERY CONTROL UNIT)
S755
TRANSMIT PROTOCOL INFORMATION AND FUNCTION ID
S756
RECEIVE CONNECTION INFORMATION REQUEST; PERFORM INFORMATION-PROVIDING PROCESSING
S757
RECEIVE PREPARATION REQUEST FOR CONNECTION STORING TUNER PROTOCOL INFORMATION AND HDD PROTOCOL INFORMATION (CMS)
S758
BIND CONNECTION ID WITH AVT INSTANCE ASSIGNED (REGISTER IN CONNECTION MANAGEMENT TABLE)
S759
TRANSMIT AVT INSTANCE ID AND CONNECTION ID
S760
RECEIVE URI SETTING REQUEST TO AVT INSTANCE (AVT INSTANCE ID, CHANNEL LIST URL)
S761
URI SETTING TO AVT INSTANCE
S762
TUNER CONTROL INSTANCE RECEIVES CONTROL REQUEST
S763
TUNER CONTROL
S764
VIDEO CAPSULE CONTROL INSTANCE RECEIVES CONTROL REQUEST
S765
VIDEO CAPSULE CONTROL
S766
RECEIVED CHANNEL SWITCHING REQUEST?
Yes
S767
CHANNEL SWITCHING BY TUNER CONTROL OF AVT INSTANCE
No
S768
RECEIVED CONNECTION ENDING REQUEST?
No
Yes
S769
CONNECTION DISCONNECTED, ENTRY DELETED FROM CONNECTION MANAGEMENT TABLE
END

FIG. 23

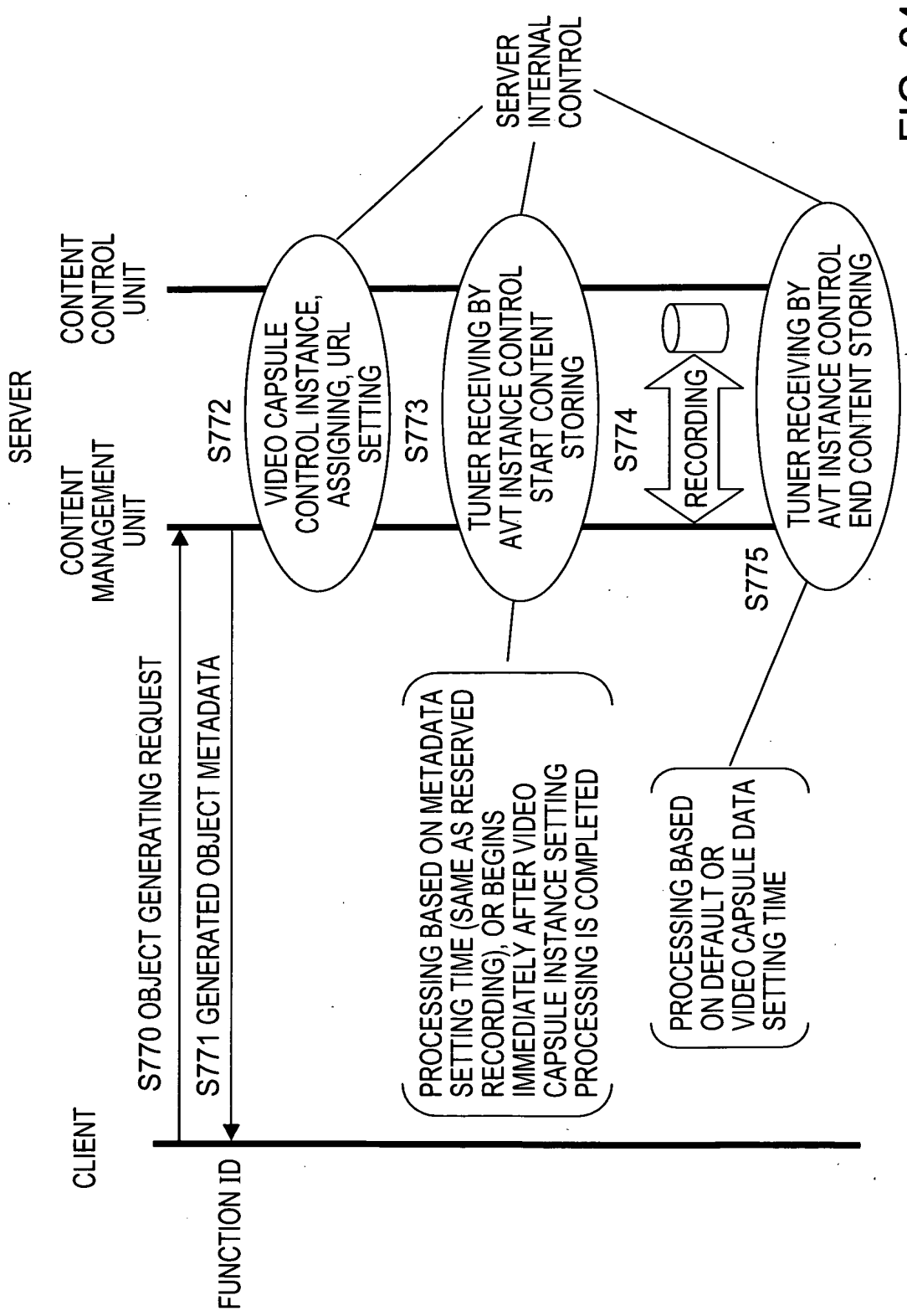
SERVER
CONTENT MANAGEMENT UNIT
CONTENT CONTROL UNIT
SERVER INTERNAL CONTROL
CLIENT
FUNCTION ID
S770 OBJECT GENERATING REQUEST
S771 GENERATED OBJECT METADATA
S772
VIDEO CAPSULE CONTROL INSTANCE, ASSIGNING, URL SETTING
S773
TUNER RECEIVING BY AVT INSTANCE CONTROL START CONTENT STORING
S774
RECORDING
S775
TUNER RECEIVING BY AVT INSTANCE CONTROL END CONTENT STORING
PROCESSING BASED ON METADATA SETTING TIME (SAME AS RESERVED RECORDING), OR BEGINS IMMEDIATELY AFTER VIDEO CAPSULE INSTANCE SETTING PROCESSING IS COMPLETED
PROCESSING BASED ON DEFAULT OR VIDEO CAPSULE DATA SETTING TIME

FIG. 24

PROPERTY	CONTENT
av:recordStatus	SPECIFY Recording.
av:recordStart DateTime	RECORDIGN START TIME. FOR LIVE RECORDINGS, 0000-00-00T00:00:00.000Z IS SPECIFIED. TIME ZONE PORTIONS MAY DIFFER.
av:recordEndDateTime	RECORDING END TIME. SPECIFICATION OF THE CLIENT IS Optional. WHETHER OR NOT THE SERVER CAN PERFORM SETTINGS IS ALSO Optional. CLIENT MUST CHECK Capability AS TO WHETHER OR NOT THIS PROPERTY CAN BE SET WITH X_GetSchema. IN THE CASE THAT SPECIFICATION IS MADE, IF THIS VIDEO CAPSULE IS IN A RECORDIGN STATE IN THE SERVER AT THIS TIME, THE RECORDING IS ENDED. IN THE CASE THAT SETTINGS ARE NOT MADE, IF SUFFICIENT TIME HAS PASSED, OR IN THE CASE THAT PROBLEMS HAVE OCCURRED WITHIN THE SERVER, THE SERVER MAY END THE RECORDING.
av:recordQuality Level	IMAGE QUALITY LEVEL AT TIME OF RECORDING. SPECIFICATION OF THE CLIENT IS Optional. CLIENT MUST CHECK THE VALUE CAPABLE OF SETTINGS.
av:recordInput FuncID	FuncID ILLUSTRATING THE FUNCIONALITY HANDLING THE CONTENT TO BE THE RECORDING SOURCE. SPECIFICATION OF THE CLIENT IS Optional. CLIENT MUST CHECK THE VALUE CAPABLE OF SETTINGS.
av:recording Method	RECORDING METHOD. SPECIFICATION OF THE CLIENT IS Optional. CLIENT MUST CHECK THE VALUE CAPABLE OF SETTINGS.
res	SHOWS RESOURCE OF THE CONTENT TO BE THE RECORDING SINK. DO NOT ADD IN THE CASE OF NOT SPECIFYING res@protocolInfo. LEAVE THE res VALUE BLANK IN THE CASE OF SPECIFYING res@protocolInfo.
res@protocol Info	PROTOCOL INFORMATION OF THE CONTENT TO BE THE RECORDING SINK. Func-id OF additionalInfo (FOURTH COLUMN) ONLY CAN BE SPECIFIED. THIS ILLUSTRATES THE FUNCTIONALITY FOR HANDLING THE CONTENT TO BE THE RECORDING SINK. THE OTHER COLUMNS ARE SPECIFIED WITH "*". SPECIFICATION OF THE CLIENT IS Optional. CLIENT MUST CHECK THE VALUE CAPABLE OF SETTINGS. EXAMPLE: *:*:*:fnc-id=hdd1

FIG. 25

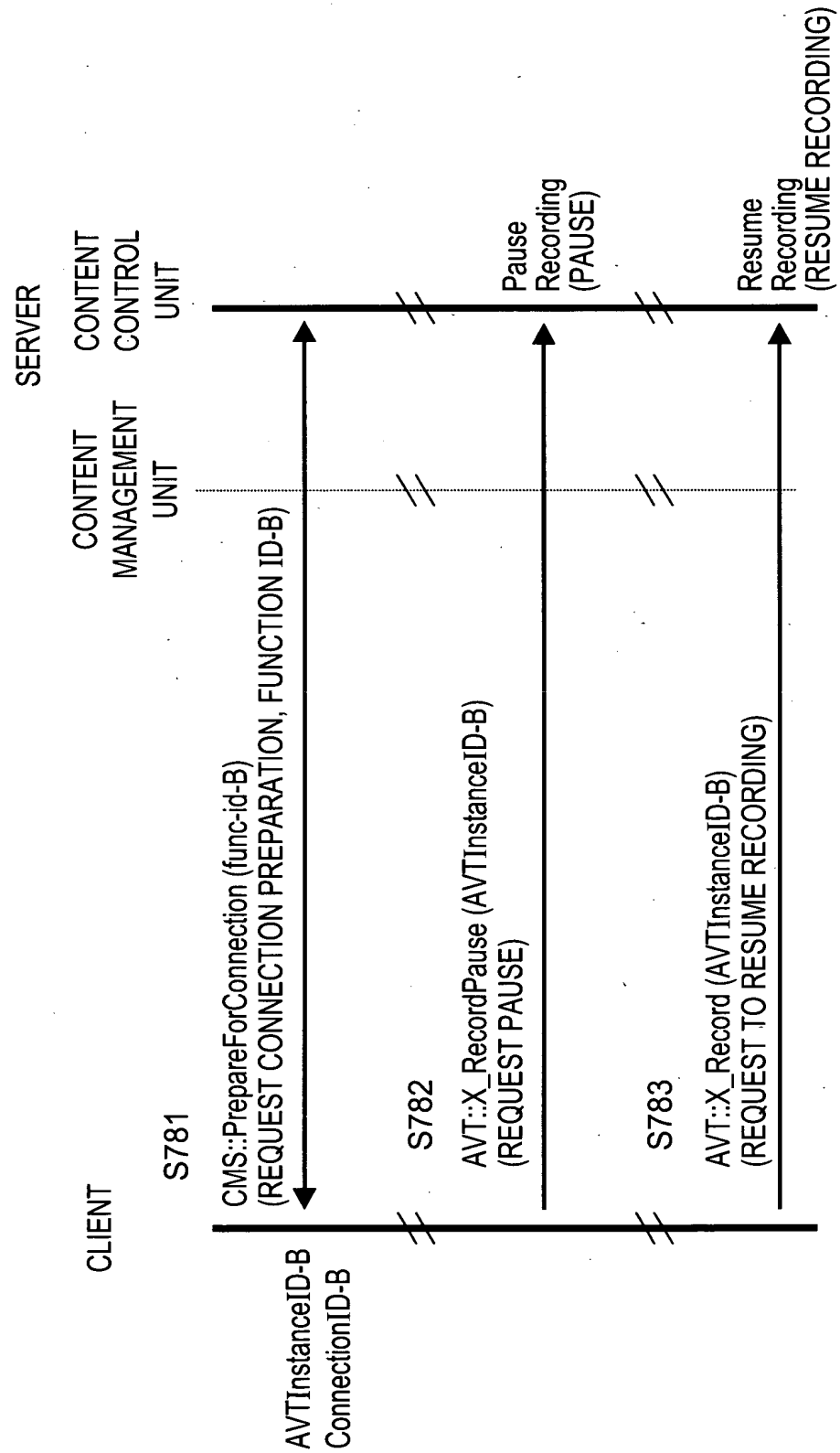
CLIENT
SERVER
CONTENT MANAGEMENT UNIT
CONTENT CONTROL UNIT
AVTInstanceID-B
ConnectionID-B
S781
CMS::PrepareForConnection (func-id-B)
(REQUEST CONNECTION PREPARATION, FUNCTION ID-B)
S782
AVT::X_RecordPause (AVTInstanceID-B)
(REQUEST PAUSE)
Pause Recording (PAUSE)
S783
AVT::X_Record (AVTInstanceID-B)
(REQUEST TO RESUME RECORDING)
Resume Recording (RESUME RECORDING)

FIG. 26

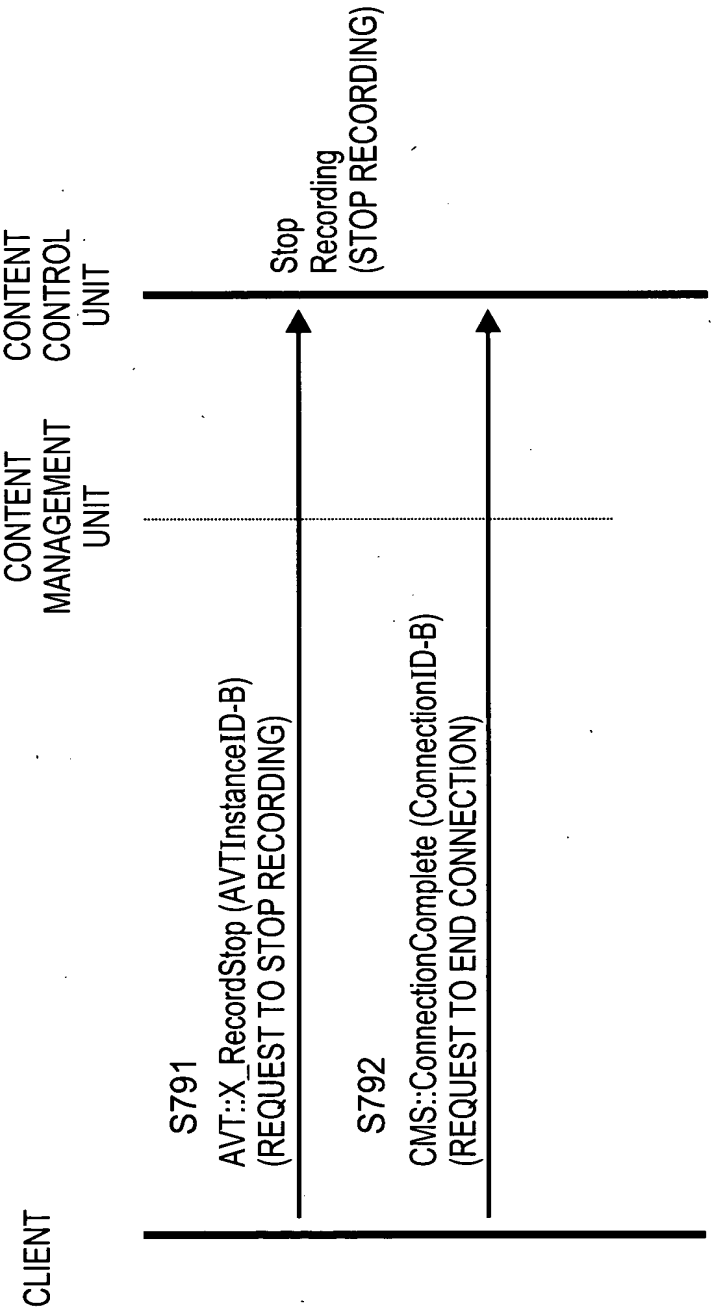
CLIENT
SERVER
CONTENT MANAGEMENT UNIT
CONTENT CONTROL UNIT
S791
AVT::X_RecordStop (AVTInstanceID-B)
(REQUEST TO STOP RECORDING)
S792
CMS::ConnectionComplete (ConnectionID-B)
(REQUEST TO END CONNECTION)
Stop Recording
(STOP RECORDING)

FIG. 27

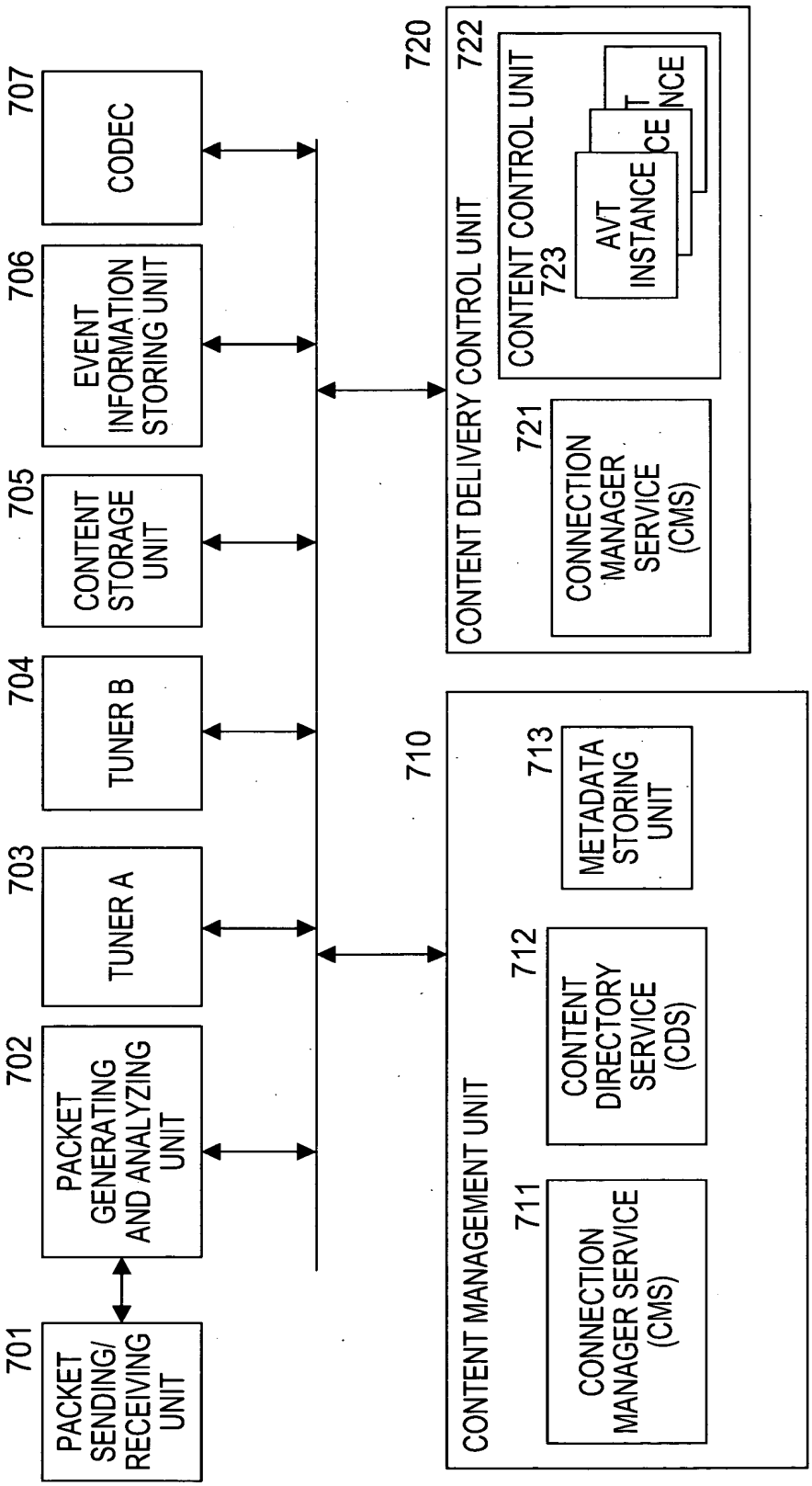
701
PACKET SENDING/ RECEIVING UNIT
702
PACKET GENERATING AND ANALYZING UNIT
703
TUNER A
704
TUNER B
705
CONTENT STORAGE UNIT
706
EVENT INFORMATION STORING UNIT
707
CODEC
710
CONTENT MANAGEMENT UNIT
711
CONNECTION MANAGER SERVICE (CMS)
712
CONTENT DIRECTORY SERVICE (CDS)
713
METADATA STORING UNIT
720
CONTENT DELIVERY CONTROL UNIT
721
CONNECTION MANAGER SERVICE (CMS)
722
CONTENT CONTROL UNIT
723
AVT INSTANCE

FIG. 28

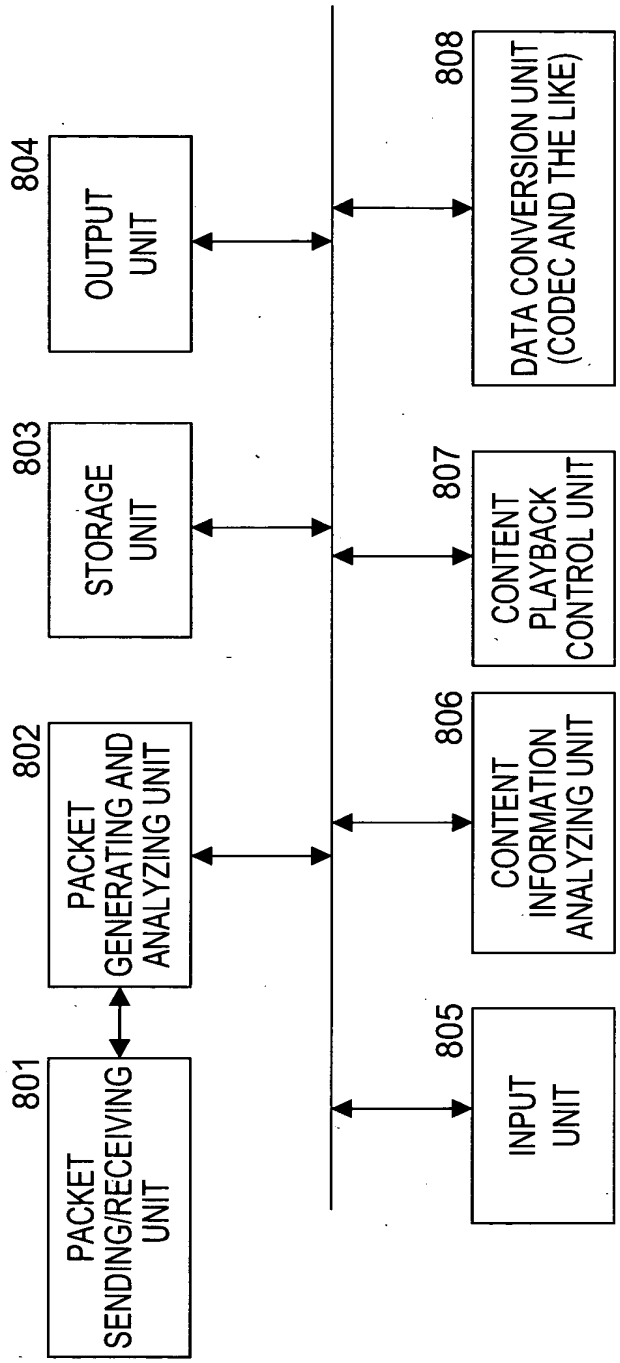
801
PACKET SENDING/RECEIVING UNIT
802
PACKET GENERATING AND ANALYZING UNIT
803
STORAGE UNIT
804
OUTPUT UNIT
805
INPUT UNIT
806
CONTENT INFORMATION ANALYZING UNIT
807
CONTENT PLAYBACK CONTROL UNIT
808
DATA CONVERSION UNIT (CODEC AND THE LIKE)

FIG. 29